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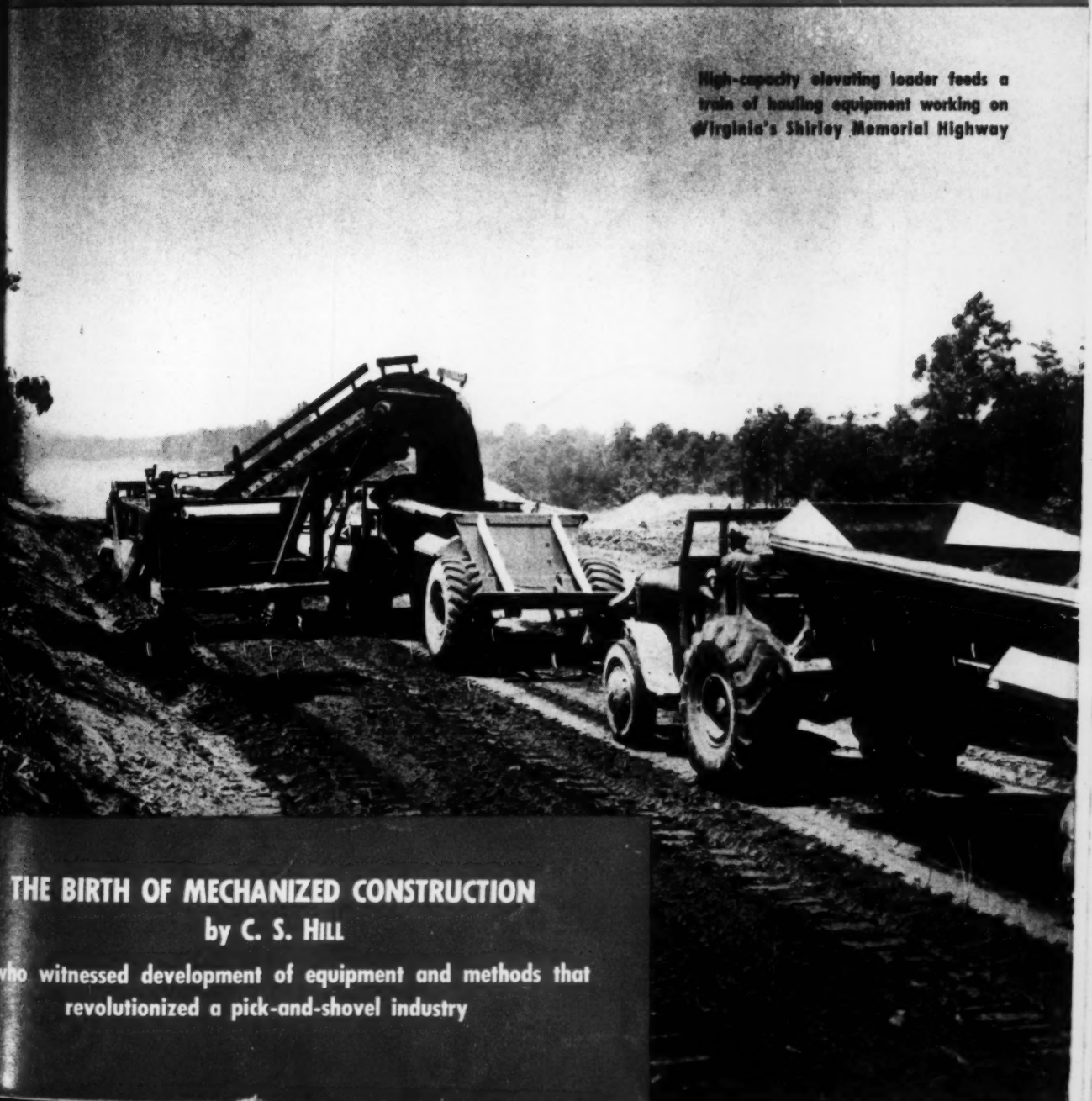
ENGINEERING NEWS-RECORD

DECEMBER 12, 1946



High-capacity elevating loader feeds a train of hauling equipment working on Virginia's Shirley Memorial Highway

THE BIRTH OF MECHANIZED CONSTRUCTION

by C. S. HILL

who witnessed development of equipment and methods that revolutionized a pick-and-shovel industry

1 *Original ARMCO Multi Plate installation—13¼ feet in diameter and 75 feet long.*

2 *This is what happened when a sudden flood washed out the road. The ARMCO Multi Plate structure was intact but was replaced by a bridge with greater flood capacity.*

3 *Making little bridges out of a big bridge was easy with ARMCO Multi Plate. Sections from the original structure were used in building this one. The same mitering was used at the ends without recutting. Two other arches, 7 feet in span and 40 feet long, were also constructed and enough plates were left for still another small bridge when needed.*

Multi Plate can be salvaged 100%

There's a song in every budget when you can offset disaster as easily as this experience shows.

When an unprecedented flood washed out a Multi Plate bridge it was replaced by a larger structure. Yet material loss was zero since the sturdy Multi Plate sections were salvaged and used to build several smaller bridges at other locations.

"Packaged" Multi Plate structures are "budget-savers" from start to finish. The easily-handled, pre-curved, corrugated plates are nested together to save space in shipping, hauling and storing. Construction is done with unskilled labor, the simplest equipment and small tools. No curing, no waste, no delay. The road is quickly opened to traffic—often without detours.

For a durable, economical job include ARMCO Multi Plate in your plans for bridges, stream enclosures, large sewers and special drainage structures. Then you'll never have to worry about being left "high and dry" should conditions change. Write today for complete data. Armco Drainage & Metal Products, Inc., 1385 Curtis Street, Middletown, Ohio

MULTI ARMCO PLATE

ARMCO Multi Plate

ENGINEERING NEWS-RECORD

Devoted to Buildings, Sewerage, Waterworks, Bridges, Roads, Dams, Foundations, Earthwork, Flood Control, Public Works, Airports, Irrigation, Canals, Tunnels, Railroads

Volume 137 • Number 24

December 12, 1946

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LOCK GATES "CRACKED" ELECTRONICALLY

To Prevent Water Surges!

AT CHICAGO, G-E THY-MO-TROL DRIVE AUTOMATICALLY CONTROLS GATES OVER A 25-1 SPEED RANGE

Speed and timing controls are combined with starting push buttons in this G-E Thy-mo-trol control station.

Timing the operation of lock gates in the Chicago River to prevent excessive current and turbulence was once a ticklish job. Two drive motors were used — one to "crack" the gate at low speed during the period when the varying water levels equalized themselves, and another for high-speed operation. This twin-motor and gear arrangement was not smooth in operation and it required considerable maintenance. It was necessary for the operator to manually supervise the gate opening, operating the gate at low speed until the water levels became adjusted, and then shifting to high speed. This method called for extreme care and attention during the entire operating cycle.

Thy-mo-trol makes speed control automatic

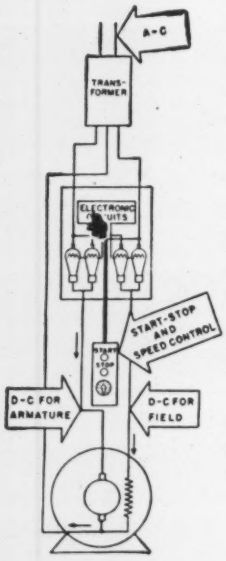


Diagram of Thy-mo-trol drive. Separate rectifier tubes supply d-c power to the motor field and d-c power to the armature.

Today, one leaf of one lock gate is opened and closed by a G-E Thy-mo-trol electronic drive and a single d-c motor, the speed of which is precisely and automatically controlled. To open the gate without hazardous water current, the operator simply sets a speed dial and a timer on a convenient panel and presses a push button. The drive motor starts at the low speed of 70 rpm to permit "cracking" of the gate and safe water equalization, and then accelerates to the high speed of 1750 rpm to complete the opening. When the gate is fully opened, the drive de-energizes itself. To close the gate, the cycle is reversed, with a smooth, final closing of the gates at a slow speed. Control is fast, completely automatic and always precise, despite the broad speed range.

D-c performance from a-c power

Wherever you have an a-c power source and you want the versatile, efficient control of speed and torque afforded by d-c motors, G-E Thy-mo-trol drive is a wise choice. We suggest you consider its basic advantages when specifying drives for conveyors, winches, lathes, material testing machines, pumps, and other driven machines. Standard drives are available from ⅛ to 25 hp. For complete details, write for Bulletin GEA-4025. Apparatus Dept., General Electric Company, Schenectady 5, N. Y.

GENERAL ELECTRIC

655-55-8080

THY-MO-TROL DRIVE

- *Fast stops with dynamic braking*
- *Smooth, fast constant-current acceleration*
- *Preset speeds*
- *Constant speed under changing loads*
- *No stop for speed change*
- *Low Maintenance*

Construction Trends

Industrial Building Construction at All-Time High

Industrial building contracts awarded during the first eleven months of 1946 total $969,754,000, a new all-time high. This year will establish a record on top of a record, since the previous all-time high year was 1945, with $635,170,000 of private industrial building contracts.

Contracts awarded in 1946 to date average $20,203,208 per week. This is 65% above the weekly average of $12,214,808 in 1945, and 92% above the weekly average of $10,525,250 in the pre-war year of 1929.

This new record has been rolled up despite government efforts to restrict this type of building. Beginning March 26, 1946, only that essential industrial building, obtaining CPA approval, was permitted, in order to divert materials and labor to the housing program. However, in spite of this apparent setback, $20,452,657 of new industrial building contracts were awarded per week after the issuance of the order, compared to $19,531,615 per week prior to the restricting order.

The following types of industries are doing this building: process industries, 43.9%; metal working plants, 14.1%; miscellaneous factories, 12.9%; food industries, 10.4%; public utilities, 7.1%; transportation service buildings, 4.8%; metal refining and rolling plants, 4.1%; textile industries, 1.7%; and wood industries, 1.0%.

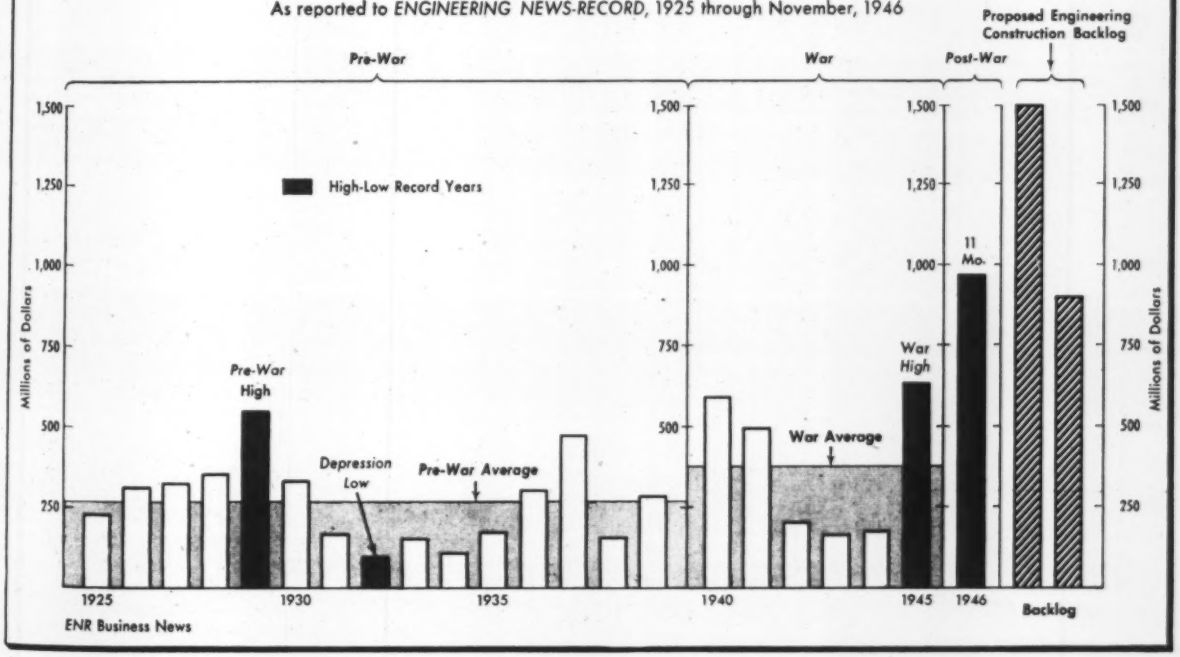
Some of the large process industry construction contracts awarded this year are for chemical plant buildings in Michigan, $25,000,000; nylon yarn plant in Tennessee, $20,000,000; engineering and research building and 100 octane cracking plant in Missouri, $20,000,000; synthetic yarn plant in Tennessee, $20,000,000; pulp and paper mill in Georgia, $13,000,000; paper mill in Florida, $10,000,000; soap and soap products plant in Missouri, $10,000,000; lubricating oil plant and refinery in Ohio; $8,000,000; lubricating oil manufacturing plant in Texas, $6,000,000; and a chlorine plant in Louisiana, $6,000,000.

In the metal refining and rolling industry, large contracts were awarded for a strip mill addition to a steel plant in California, estimated to cost between $10,000,000 and $15,000,000, a steel bar and billet mill in Pennsylvania, $6,000,000, and a sheet and tin plate mill in California, $6,000,000. In the public utility classification, a power plant contract in Delaware was awarded for $13,000,000, and a power plant in Pennsylvania, awarded for $5,000,000. One of the large metal working contracts was for an assembly plant, service and acetylene buildings in Georgia for $6,500,000.

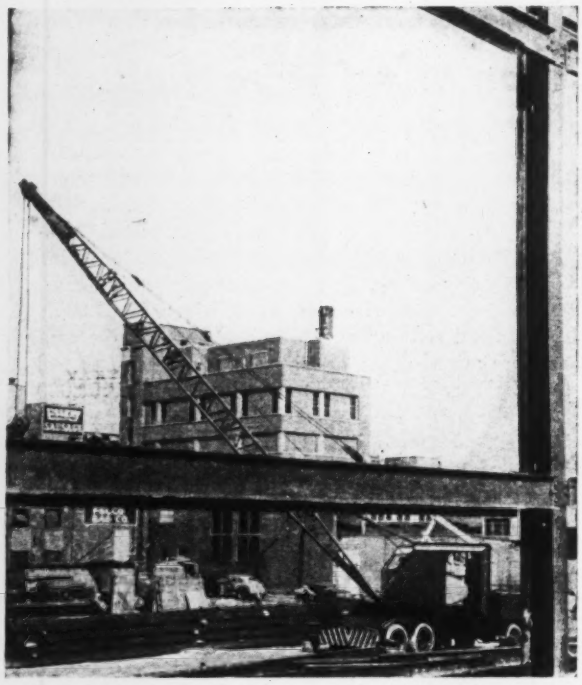
The measured backlog of proposed industrial building construction, reported by Engineering News-Record, now totals $2,400,673,000. During 1946, $397,862,000 came out of the backlog as proposed projects advanced to contract status. However, these made up only 41% of the total contracts recorded in 1946. Accordingly, at this rate, the backlog should be sufficient to support five years of industrial construction at present record volume.

PROPOSED BACKLOG OF INDUSTRIAL BUILDING CONSTRUCTION COMPARED WITH ANNUAL CONTRACT VOLUMES

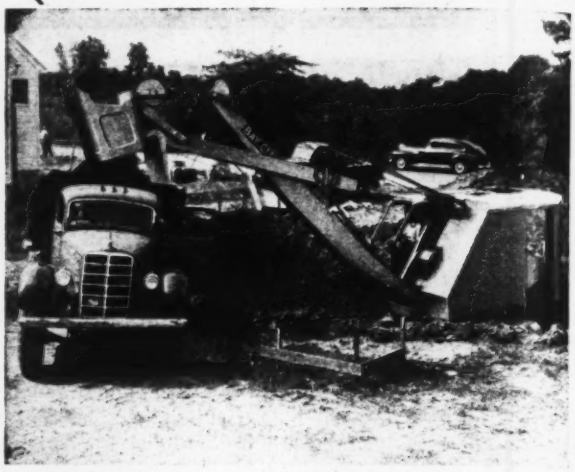
As reported to *ENGINEERING NEWS-RECORD*, 1925 through November, 1946



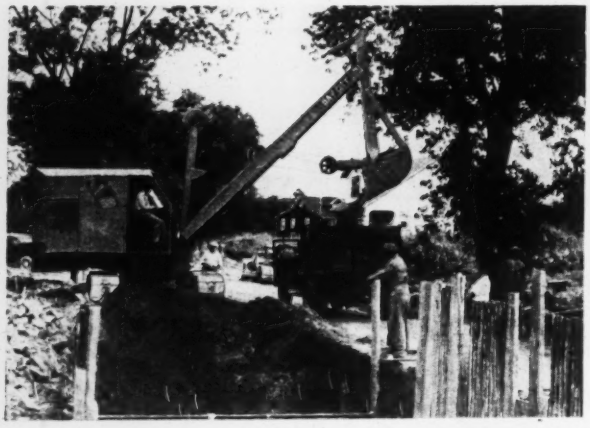
FOURFOLD SATISFACTION! Maryland Contractor Cleans up on Excavating and Erection Jobs with ~~FOUR~~ five DIFFERENT BAY CITY CRANES



Here is the newest addition to William A. Harting's (Landsdowne, Md.) fleet of BAY CITY equipment—a 20 ton capacity CraneMobile for steel erection with long boom and jib for handling heavy loads with stability, safety and ease of operation that come from fine engineering and sturdy construction.



Mr. Harting will tell you his ¾ yard shovel is a consistent money-maker. Basement digging is only one of many excavating jobs which can be handled swiftly and efficiently. Ask him about the BAY CITY design features which add up to low-cost yardage.



This husky ¾ yard back-hoe working on a storm sewer project gets by in tight spots because of flexibility in handling, easy maneuverability and long reach of better than 31 feet. Oh yes!—and digging depth more than 18 feet.

For clean-up work and other odd jobs, this convertible crane is loading trucks with ⅜ yard clamshell bucket. If you would like full particulars on BAY CITY equipment, see your nearest dealer or write direct to BAY CITY SHOVELS, Inc., Bay City, Michigan.

BAY CITY

SHOVELS • CRANES • DRAGLINES • TRENCH HOES

SEE YOUR NEAREST DEALER for Bay City excavating and material handling equipment in sizes from ⅜ to 1¼ yards having crane rating up to 20 tons. Both crawler and pneumatic tire mounting.

New Construction Volume in November

Civil engineering construction volume in continental United States totals $275,825,000 for November, an average of $68,956,000 for each of the four weeks of the month. This average is 29 percent below the average for October, and is 9 percent above the average of November, 1945, according to *Engineering News-Record.*

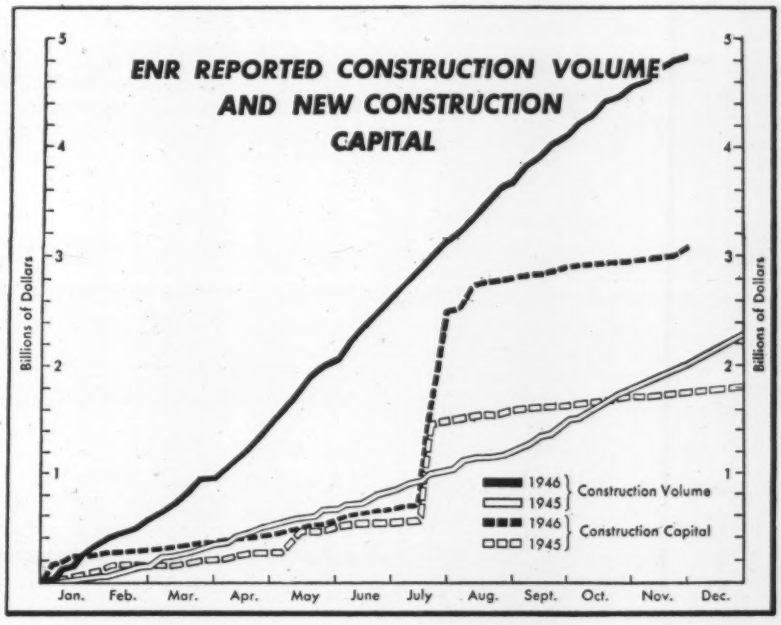
Private construction for November on a weekly average basis is 42 percent below last month, but 27 percent less than November, 1945. Public construction is 10 percent below last month, and 111 percent above last November. State and municipal construction, while 39 percent below last month, is 121 percent above the average for November, 1945. Federal construction, up 258 percent from last month, is 97 percent above November, 1945.

Weekly averages in the various classes of construction for November, 1946 compared with October, show gains in public buildings of 16 percent; earthwork and drainage, 312 percent; and private unclassified, 22 percent; losses in highways, 30 percent; waterworks, 57 percent; sewerage, 39 percent; industrial buildings, 74 percent; commercial buildings, 14 percent; public bridges, 7 percent; and public unclassified, 58 percent.

Geographically, only one section showed gains in November, 1946 over October—Far West, 50 percent. New England dropped 54 percent below October; Middle Atlantic, 31 percent; South, 59 percent; Middle West, 33 percent; and West of the Mississippi, 34 percent.

Four sections made gains in November over November, 1945—New England, 9 percent; South, 19 percent; West of Mississippi, 24 percent; and Far West, 34 percent. Middle Atlantic dropped 1 percent below last year, and Middle West 25 percent.

New capital for construction purposes for the four weeks of November, 1946 totals $139,005,000. On a cumulative basis, new construction capital in 1946 totals $3,093,123,000, 76 percent greater than the 1945 11-month total of $1,752,837,000.

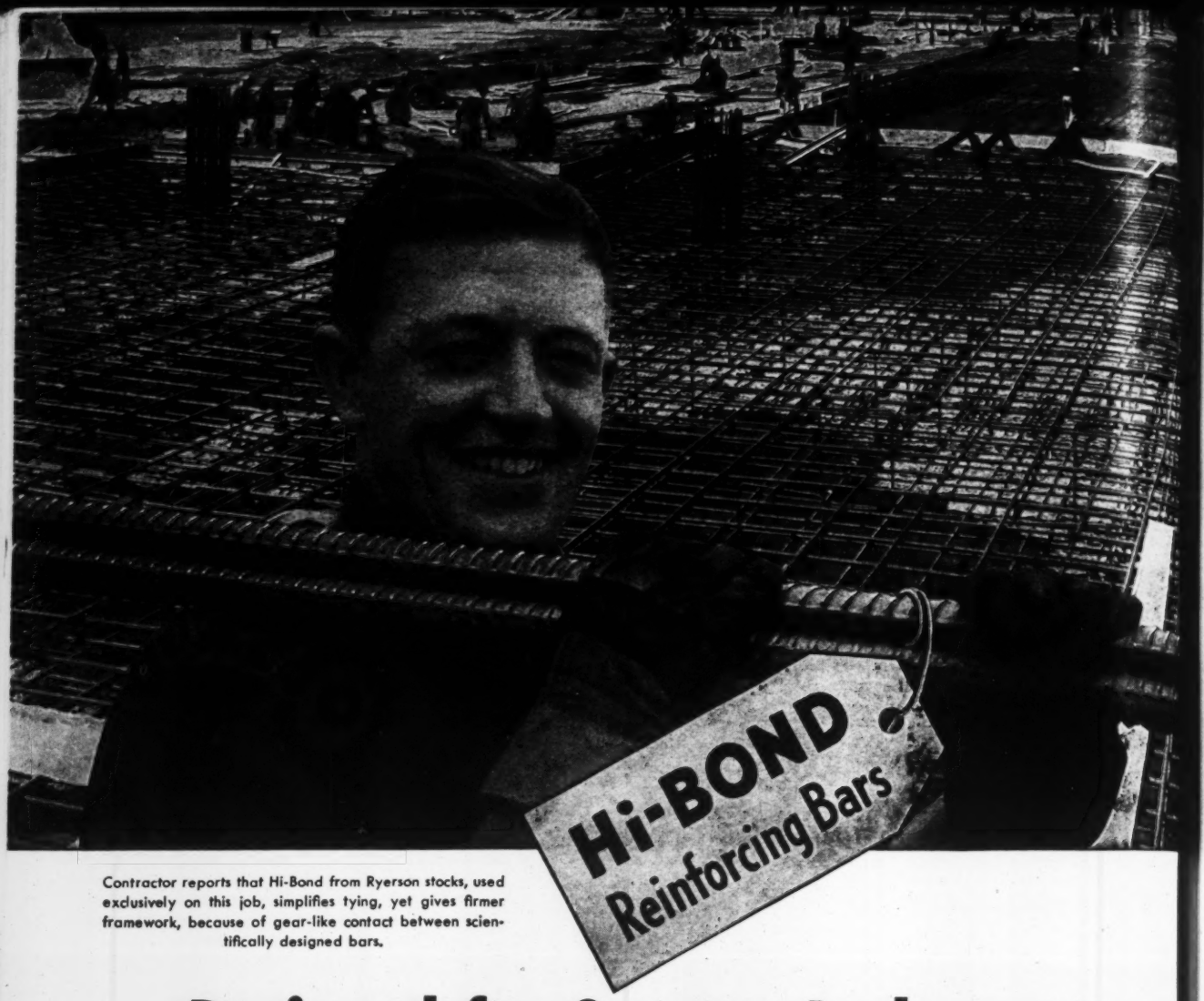


ENGINEERING CONSTRUCTION CONTRACTS REPORTED TO ENGINEERING NEWS-RECORD—NOVEMBER, 1946

Engineering News-Record *reports continental U. S. Construction projects of the following minimum costs — Waterworks, excavation, drainage and irrigation,* $22,500; *other public works,* $40,000; *industrial buildings,* $55,000; *other buildings,* $205,000

Four Weeks — Thousands of Dollars (000 Omitted)

	New England	Middle Atlantic	South	Mid West	West of Mississippi	Far West	United States November	United States Eleven Months 1946	United States Eleven Months 1945	Canada
Public Works										
Waterworks	77	314	1,263	340	932	2,930	5,856	101,414	53,962	356
Sewerage	.....	182	2,526	2,385	2,801	1,459	9,353	105,836	31,874	273
Bridges, public	143	487	987	1,618	1,731	2,424	7,390	120,497	36,026	144
Earthwork and waterways	34	180	245	.....	6,018	17,113	23,590	343,492	54,086	3,081
Streets and roads	681	5,875	5,471	6,350	15,299	10,879	44,555	725,581	206,475	588
Buildings, public	575	22,723	2,770	2,155	9,448	7,780	45,451	388,134	448,483	3,536
Unclassified, public	.....	575	380	435	2,670	842	4,902	151,125	248,479	267
Total public	1,510	30,336	13,642	13,283	38,899	43,427	141,097	1,936,079	1,079,385	8,245
Federal government (incl. in above classifications)	290	20,494	204	225	14,108	19,670	54,991	613,319	729,323	.....
Private										
Bridges, private	.....	.....	.....	.....	.....	.....	.....	2,092	3,981	.....
Industrial buildings	1,029	2,775	4,257	4,528	9,872	6,980	29,441	969,754	545,746	4,183
Commercial buildings	6,905	33,743	15,093	15,650	6,907	18,636	96,934	1,758,174	312,401	2,350
Unclassified, private	75	141	873	1,295	5,298	671	8,353	181,344	109,886	1,109
Total private	8,009	36,659	20,223	21,473	22,077	26,287	134,728	2,911,364	972,014	7,642
Total Engineering Construction:										
November, 1946 — 4 weeks	9,519	66,995	33,865	34,756	60,976	69,714	275,825	.....	.....	15,887
October, 1946 — 5 weeks	26,091	121,508	103,373	64,473	114,750	58,062	488,457	.....	.....	23,177
November, 1945 — 5 weeks	10,955	84,953	35,512	57,766	61,416	65,107	315,709	.....	.....	21,970
Eleven Months — 1946	279,811	1,146,502	752,781	587,545	993,937	1,086,867	.....	4,847,443	.....	288,310
Eleven Months — 1945	85,758	390,690	283,953	384,132	430,201	476,665	.....	.....	2,051,399	151,128



Contractor reports that Hi-Bond from Ryerson stocks, used exclusively on this job, simplifies tying, yet gives firmer framework, because of gear-like contact between scientifically designed bars.

Designed for Greater Anchorage in Concrete Construction

Shipped Promptly from Ryerson Stocks

Here's a combination that always gives top performance —Hi-Bond bars plus Ryerson reinforcing service. As with other steel products today the needed size or quantity of Hi-Bond has sometimes been difficult to obtain. But all Ryerson plants offer service on a wide range of construction steels and Ryerson plants in Chicago, Detroit and Cincinnati regularly stock Hi-Bond rounds in sizes from ⅜ to 1.53 inches (1¼″ square equivalent) and greater tonnage should be available before long.

More and more engineers are specifying Hi-Bond because laboratory tests conclusively prove that scientific Hi-Bond design creates a greater bonding grip with concrete. This means better, stronger construction and an increased resistance to the formation of tensile cracks.

More and more contractors are using Ryerson reinforcing service because Ryerson handles the complete job from setting plans to delivery with speed and accuracy. Bars are cut, bent and correctly tagged for easy placement. Ryerson deliveries are completely flexible to the changing needs of the job schedule.

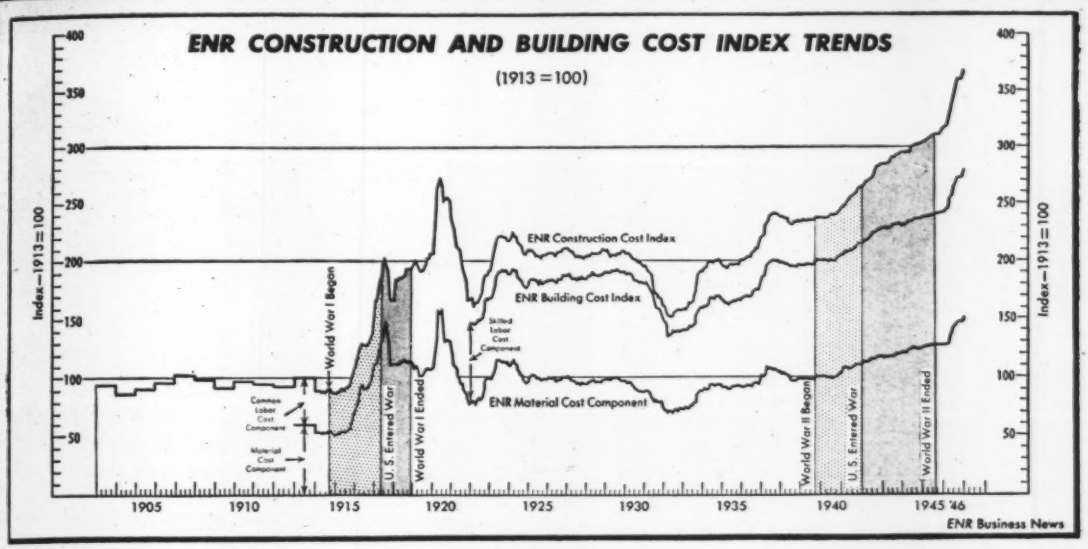
If you have been unable to secure reinforcing from Ryerson stocks during the present steel shortage we suggest you try again. You will be pleased with the time and trouble saving advantages of Ryerson service. And remember Ryerson stocks of the unique Hi-Bond bar when planning new construction.

In addition to Hi-Bond, Ryerson stocks include a broad range of other construction steels—structurals, plates, steel spirals, reinforcing accessories, forms for concrete joist construction, bolts, rivets, etc. Write for Stock List.

Joseph T. Ryerson & Son, Inc. Steel-Service Plants at: Chicago, Milwaukee, Detroit, St. Louis, Cincinnati, Cleveland, Pittsburgh, Philadelphia, Buffalo, New York, Boston.

RYERSON STEEL

DECEMBER CONSTRUCTION BUSINESS REPORT



ENR CONSTRUCTION VOLUME AND NEW PRODUCTIVE CAPITAL

Thousands of Dollars (,000 omitted)	November 1945 (5 wk.)	November 1946 (4 wk.)	% Change	Eleven Months 1945 (48 wk.)	Eleven Months 1946 (48 wk.)	% Change
Total U. S. Construction	$315,709	$275,825	−13	$2,051,399	$4,847,443	+136
Private Construction	232,067	134,728	−42	972,014	2,911,364	+200
Public Construction	83,642	141,097	+69	1,079,385	1,936,079	+79
Federal	34,856	54,991	+58	729,323	613,319	−16
E N R Construction Volume Index, 1913 = 100	173	164	−5	119	254	+113
Total New Productive Capital	$38,338	$139,015	+263	$1,752,837	$3,093,123	+76
Private Investment	38,338	139,015	+263	539,339	1,195,141	+122
Federal (non-federal work)	.....	.....	.....	163,600	225,000	+38
Federal (federal work)	.....	.....	.....	1,049,898	1,672,982	+59

CONSTRUCTION COST .... WAGE RATES .... MATERIAL PRICES

1913 = 100	December 1945	December 1946	% Change	Change November to December 1945 Nov.	1945 Dec.	%	Change November to December 1946 Nov.	1946 Dec.	%
ENR Constr. Cost Index*	313.48	368.10	+17.42	309.28	313.48	+1.4	362.47	368.10	+1.55
ENR Building Cost Index*	240.82	278.49	+15.64	240.55	240.82	+0.1	273.71	278.49	+1.75

* *Does not reflect increased costs due to overtime, lower labor efficiency, delivery delays, etc.*

ENR 20-CITIES' AVERAGE

	December 1945	December 1946	% Change	Change November to December 1945 Nov.	1945 Dec.	%	Change November to December 1946 Nov.	1946 Dec.	%
Common Labor	$0.938	$1.085	+15.67	$0.917	$0.938	+2.3	$1.078	$1.085	+0.65
Skilled Labor (Av. 3 Trades)	1.681	1.863	+10.83	1.677	1.681	+0.2	1.855	1.863	+0.43
Bricklayers	1.772	1.974	+11.40	1.772	1.772	0	1.968	1.974	+0.30
Structural Ironworkers	1.729	1.876	+8.50	1.729	1.729	0	1.865	1.876	+0.59
Carpenters	1.550	1.736	+12.00	1.530	1.550	+1.3	1.730	1.736	+0.35
Cement, per barrel	2.740	3.154	+15.11	2.740	2.740	0	3.112	3.154	+1.35
Reinforcing Steel, cwt.	2.790	3.357	+20.32	2.790	2.790	0	3.370	3.357	−0.39
Structural Steel, base	2.100	2.350	+11.90	2.100	2.100	0	2.350	2.350	0
Sand, per ton	1.250	1.529	+22.32	1.240	1.250	+0.8	1.517	1.529	+0.79
Lumber, 2x4 Fir, per M ft.	54.580	72.172	+32.23	55.630	54.580	−1.8	69.780	72.172	+3.43
Lumber, 2x4 Pine, per M ft.	53.440	67.739	+26.76	53.840	53.440	−0.5	64.311	67.739	+5.33
Common brick, per M	19.910	22.325	+12.13	19.580	19.910	+1.7	22.225	22.325	+0.45
Ready-mixed concrete, c.y.	7.640	8.438	+10.45	7.630	7.640	+0.1	8.323	8.438	+1.38
Struct. clay tile, 3x12x12	89.220	98.673	+10.60	86.330	89.220	+3.3	98.379	98.673	+0.30

MATERIAL SHIPMENTS .... BUILDING PERMITS

	November 1945	November 1946	% Change	October 1946	% Change October to November
Steel (% operating Capacity) A.I.S.I.	80.8	86.1	+7	90.2	−5

	September 1945	September 1946	% Change	Nine Months 1945	Nine Months 1946	% Change
Cement, thous. bbl. U.S.B. of Mines	11,211	17,153	+53	76,643	125,318	+64

	October 1945	October 1946	% Change	Ten Months 1945	Ten Months 1946	% Change
Fabricated Structural Steel, tons, A.I.S.C.	62,147	149,273	+140	623,891	1,236,805	+98
Building Permits, 215 Cities, Dun & Bradstreet (,000 Omitted)	$161,851	$170,491	+5	$890,642	$2,249,547	+153

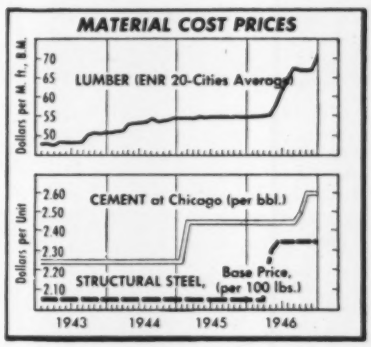
COST OF LIVING INDEX .... EMPLOYMENT

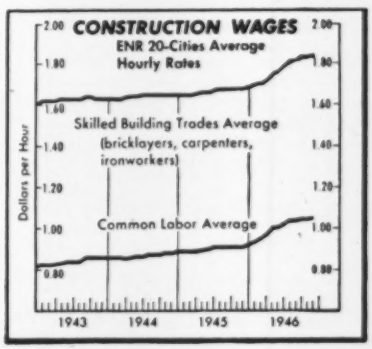
	October 1945	October 1946	% Change	September 1946	% Change September to October
Consumers' Price Index, B L S	128.9	148.4	+15.1	145.9	+1.7
Rent (Housing) Index, B L S	108.3	108.8	+0.5	108.8	0

	November 1945	November 1946	% Change	October 1946	% Change October to November
Const. Employment (est.), thous., B L S	1,183	2,184	+84.6	2,292	−4.7
Private Const. Employ. (est.), thous., B L S	953	1,723	+80.8	1,812	−4.9

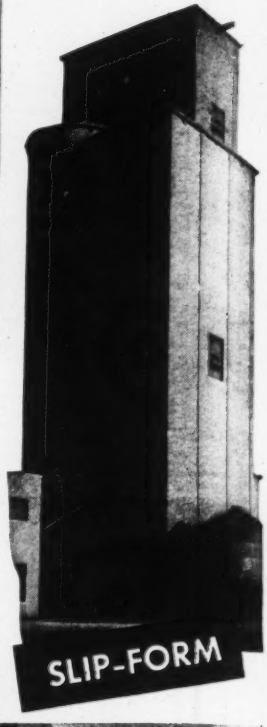
ENR INDEX NUMBERS

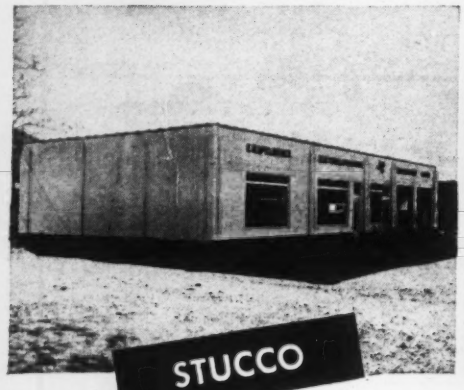
Base = 100	Construction Cost 1913	Construction Cost 1926	Building Cost 1913	Building Cost 1926	Volume '13	Volume '26
Dec., 1946	368.10	176.95	278.49	150.54	...	...
Nov., 1946	362.47	174.24	273.71	147.96	164	72
Oct., 1946	360.94	173.50	272.74	147.43	233	102
Sept., 1946	360.19	173.14	272.04	147.06	223	98
Aug., 1946	361.37	173.71	271.98	147.02	258	113
July, 1946	353.89	170.11	266.13	143.86	327	144
June, 1946	347.91	167.24	264.16	142.80	344	151
May, 1946	339.69	163.29	257.25	139.06	284	125
April, 1946	334.59	160.83	254.37	137.50	340	149
Mar., 1946	323.83	155.66	245.41	132.66	256	112
Feb., 1946	319.52	153.59	243.94	131.86	167	73
Jan., 1946	316.32	152.05	242.23	130.94	189	83
Dec., 1945	313.48	150.69	240.82	130.18	163	71
Nov., 1945	309.28	148.67	240.55	130.00	173	76
Oct., 1945	309.28	148.67	240.35	129.93	167	73
1945 (Av.)	307.74	147.93	239.14	129.27	123	54
1944 (Av.)	298.63	143.39	234.73	126.89	95	42
1943 (Av.)	289.95	139.38	228.75	123.66	176	77
1942 (Av.)	276.31	132.82	222.39	120.22	553	243

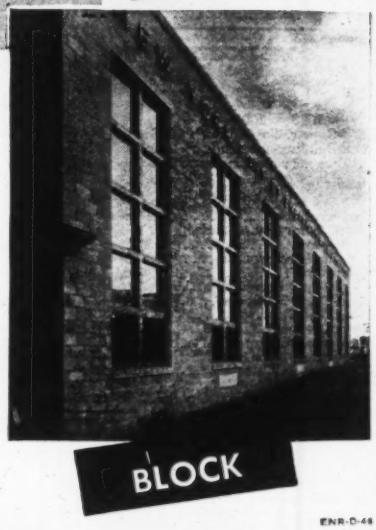




ADAPTABILITY TO CONCRETE CONSTRUCTION







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ENR-D-48

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News of the Week

ENGINEERING NEWS-RECORD • DECEMBER 12, 1946 • VOLUME 137 • NUMBER 24

Need for more road funds stressed at highway meeting

Engineers at Highway Research Board session told that rising costs are cutting maintenance and urgent new work to dangerously low levels

Subjects not generally associated with research came up for active discussion at the annual meeting of the Highway Research Board in Washington, Dec. 5-8. They were the growing need for more funds for maintenance, for reconstruction and for new highways. This need arises from a variety of causes.

Higher costs are reducing the amount of work that can be done for each dollar, engineers were told, and scarcities of labor and materials have limited the amounts of both maintenance and new construction that could be accomplished to date. This has added to the maintenance and construction deferred on account of the war and has created a condition that is growing more serious each day.

Use of planning data

These growing needs first came up for active consideration in a discussion of use of the data collected by the highway planning surveys by Charles M. Noble, state highway engineer of New Jersey, and R. E. Jorgensen, director of highway planning in Connecticut. It came up again in the session devoted to maintenance.

Mr. Noble said that until the depression of the 1930's New Jersey had been able to keep up reasonably well with growing needs, but that diversion of highway funds since then, along with the later curtailments due to the war, and the damage resulting from war traffic, had set the state's highway work back so badly that now it is difficult to see how even urgent needs are to be met. This condition, Mr. Noble said, gave added significance to proper evaluation of the data collected by the planning surveys. He added that needs must be related to revenues to determine whether added taxes or bond issues are needed.

Mr. Noble pointed out that neglect of highways can have a detrimental effect on a state's whole economy if permitted to go so far as to handicap its industries. Therefore, he pointed to the need for impressing that fact on the general public and on members of the legislature.

How Connecticut is going about selling the state legislature on its growing needs for more highway money was described by Mr. Jorgensen. Connecticut requires $99,000,000 for its 5-year program of work for which there is great need and has only $31,000,000 available for that period. As a result, the highway department is getting out a report in which the needs and lack of funds are set forth largely in diagrammatic form. It is planned to enlarge some of the charts for use as posters in the Capitol when the legislature meets. Later, these may be turned over to local chambers of commerce for use in educating the public.

Thomas B. Dimmick of the Public Roads Administration said that data collected by the surveys can be of great help to the highway departments in public relations and in building up recognition of the deficiencies of highway systems.

Turning to the more specific problems of programming highway work, Mr. Dimmick said that studies of the volume and weight of highway traffic can be used to determine where obsolescence is approaching before it begins to be evident in the field. He said also that part of the information collected by the planning surveys is of great value to cities in planning arterial streets and should be made available to them.

Planning aid for cities

J. Carl McMonagle, director of the

(*Continued on p. 89*)

Civil engineer loses fight for re-instatement

In a decision of interest to municipal engineers, the Pennsylvania State Supreme Court has affirmed the right of the director of the Pittsburgh Department of Public Works to decide who is to be retained when engineering positions are reduced in number.

The court upheld the decision of an Allegheny County Common Pleas Court which ruled against Henry E. Crede's attempt to compel the Civil Service Commission and city officials to reinstate him as senior of three assistant engineers in the Pittsburgh Division of Surveys and Designs of the Department of Public Works. The decision marked the end of a 4-year legal battle by Crede to force his reinstatement.

The case arose when two of the three positions were eliminated by Pittsburgh's City Council for the year 1943. Crede in his suit claimed the public works director did not exercise discretion in determining which assistants should be discharged.

Elevator safety code is being revised

The American Standard Safety Code for elevators, dumbwaiters, and escalators, sponsored jointly by the American Institute of Architects, the National Bureau of Standards, and the American Society of Mechanical Engineers, is being revised.

The usual periodic revision scheduled for 1943 was held in abeyance because of war. The 1947 edition is expected to be clearer than previous editions.

Communications should be addressed to the American Society of Mechanical Engineers, 29 West 39th Street, New York 18, New York, attention C. B. LePage, Technical Secretary; American Institute of Architects, attention Theodore I. Coe, Technical Secretary, 1741 New York Avenue, N. W., Washington 6, D. C.; or to the National Bureau of Standards, Washington 25, D. C., attention of J. A. Dickinson, Secretary of the Sectional Committee. The work follows the procedure of the American Standards Associations.

NEWS IN BRIEF

In telegraphic form, here are latest news developments on the engineering and construction front during the week.

Construction—The volume of planned construction in *Delaware* totals at least $125,000,000. . . . Corn Products Co. has bought 150 acres at *Corpus Christi, Tex.*, for a $10,000,000 factory. . . . N. Y. Life Insurance Co. is planning an apartment building on the block bounded by 2d and 3d Aves. and E. 65 & 66 Sts. *N. Y. City*. . . . Rust Engineering Co. has a contract for a $1,000,000 power plant for the Roeblings at *Roebling, N. J.* . . . CPA has approved a building at *Beloit, Wis.*, for Fairbanks Morse & Co. . . . CPA approved a $2,530,000 plant for the American Radiator and Standard Sanitary Corp. at *Torrance, Calif.* . . . Tulane University has CPA approval for a $300,000 project at *New Orleans, La.* . . . CPA has approved the first half of a $2,000,000 plant for the I. F. Laucks division of Monsanto Chemical Co. at *Seattle, Wash.* . . . Idaho will receive bids Dec. 27 for ten buildings to cost about $700,000, for the State Hospital at *Blackfoot* and the State School at *Nampa*. . . . Construction of a $1,466,000 manufacturing plant for General Electric at *Pittsfield, Mass.*, has been approved. . . . Shell Oil Co. will begin soon the construction of a $10,000,000 manufacturing plant at *Houston, Tex.* . . . Illinois Bell Telephone Co., *Chicago*, has announced a $160,000,000 modernization and expansion program for a period of 7 or 8 years. . . . *Toledo, Ohio*, has a 5-year plan for 14 parks on playgrounds to cost over a million and a half dollars. . . . Clay County, Ill., has been given CPA approval for a $325,000 hospital at *Flora, Ill.* . . . Ohio Fuel Gas Co., Columbus, is building the largest propane storage plant in the world at its *Mt. Sterling* compressor stations, and another similar plant is being built near *Perrysburg*. . . . *Illinois* cities and counties expect to build at least $411,990,406 worth of public works out of their own funds in the next four years. . . . It is expected that contracts will be let early next year for a $1,000,000 Northern Indiana hospital for cripplied children at *South Bend*. . . . Central Illinois Electric and Gas Co. will launch an additional $9,000,000 project at *Rockford, Ill.*, next year.

Highways—*Cleveland, Ohio*, expects to put $6,000,000 into roads next year. . . . A large 1947 appropriation is to be sought from the *West Virginia* legislature for secondary roads in that state. . . . The $500,000 re-inforced concrete D. J. Bailey bridge was dedicated at *Lynn Haven-Southport, Fla.*, Nov. 16. . . . A shortage of engineers and technicians is threatening a slowdown of the highway program in *Texas*. . . . During the first postwar year North Carolina spent $27,760,909 on contracts for surfacing, repair and grading of 2,112 miles of highway.

Water supply and sewers—*Brewster, Mass.*, has taken first steps toward building a $225,000 water system. . . . *Centralia, Wash.*, is preparing plans for a $200,000 sewerage improvements. . . . Bids are being sought for a $300,000 water works extension at *Emporia, Kan.* . . . *Harrisburg, Pa.*, is seeking a federal-state grant to cover engineering costs of preparing plans for a sewage treatment. . . . Illinois Water Co. has submitted plans for $520,000 of water supply improvements at *Champaign, Ill.* . . . *Daytona Beach, Fla.* is receiving bids for the installation of a $1,110,000 storm sewer project." Blythe Bros., of Charlotte, N. C., have been awarded a $623,000 contract by *Albany, Ga.*, for sanitary sewer improvements. . . . The Federal Works Agency has approved the request of *Toledo, Ohio*, for $120,000 to prepare plans for a $4,553,000 expansion of the city's sewage treatment plants in *Bay View Park*. . . . Sixty-six cities in *Oregon* plan sewage system improvements costing an estimated $17,506,797, according to Curtis M. Everets, Jr., state sanitary engineer. . . . *Watsontown, Pa.*, has announced plans for a sewage treatment plant and sewers. . . . As a first step in a large sanitary and storm sewer project for *Peoria, Ill.*, the city council, Nov. 5, awarded contracts to K. C. Leiter and Associates, for planning a proposed $285,717 storm sewer system, and to Austin Engineering Co., for another proposed $125,000 storm sewer. . . . *Milton, Pa.* announced plans for construction of sewers and a sewage plant to cost $480,000.

Phila. refuses to halt improvement program

Philadelphia, Pa., has refused to halt its $350,000,000 postwar improvement program although requested by the federal government. Mayor Bernard Samuel said that postponement of the program would jeopardize the public welfare and again postpone projects "long overdue by reason of the depression, war and postwar conditions."

Thus it is expected that the city's multi-million dollar program will move ahead following the mayor's emphatic refusal to accede to the request of Maj. Gen. Philip B. Fleming, administrator, Federal Works Agency, that the program be delayed until the supply of building materials increases.

Mayor Samuel said: "There exists in Philadelphia a specific group of public works improvements the completion of which is a vital necessity. It includes a citywide sewage treatment project; a rehabilitation of the water works system; construction of sewers to eliminate bad sanitary conditions and to remedy flooding of properties during heavy storms. The main objective of the sewage treatment project, the city's most important problem, is to rid the Schuylkill and Delaware rivers of all pollution. We are compelled by statutory mandate and State Board of Health requirements to complete this project at the earliest possible date. The continued deferment of this improvement and other projects mentioned cannot go on indefinitely."

CPA clarifies rule on HH-priority ratings

Suppliers of building materials subject to HH-priority ratings are not prohibited from selling that kind of materials on unrated orders, the Civilian Production Administration has pointed out in commenting on regulations for channeling those materials into the Veterans' Emergency Housing Program. Moreover, for most of those materials, no set-aside of stock for future rated orders is required.

In the case of a few of the materials, suppliers are required to set aside materials for rated orders. These suppliers' set-asides are all less than 100 percent, with the exception of prefabricated houses, sections, and panels.

These materials are controlled by CPA's Schedules A and B to Priorities Regulation 33. Schedude A lists the materials for which HH ratings may be used by builders, contractors, etc. Schedule B contains special provisions for the distribution of those materials. For most of the Schedule A materials no setaside is required. Instead, the regulations merely require that rated orders, when received, be filled in preference to unrated orders. This is a limited requirement, since suppliers do not have to use their whole stock for filling rated orders received. Instead, the "ceiling" provisions explained in Schedule B prevent ratings from pre-empting the entire supply since they permit suppliers to use a part of their supply for unrated orders.

Wyatt, housing agency chief, resigns; building industry controls remain

Housing expediter censures "organized, vocal" group—John D. Small, Civilian Production Administration head, quits post

Placing responsibility for his departure on "very vocal and well organized opposition", Wilson W. Wyatt resigned Dec. 5 after serving nearly a year as National Housing Expediter.

On the same day, President Harry S. Truman announced he had accepted the resignation of John D. Small from his post as director of the Civilian Production Administration.

Controls over the construction industry maintained by the two agencies, however, remained in force last week, pending the formation of a new over-all agency that may take over the tasks now assigned to the dwindling Office of Price Administration. CPA and other wartime government agencies. The fate of the National Housing Agency was uncertain, although Mr. Wyatt, in a final press conference, said he expected the agency to continue as an independent organization.

The controls still in force include: Limitations on non-residential construction; priorities for channeling regulations to provide materials for housing construction; the $10,000 ceiling on new home sales, and the $80-per-month ceiling on rentals for new homes; veterans' preference on purchase of new homes; subsidies for the production of materials for housing; guaranteed markets for prefabricated homes, and rent controls on existing home and apartment units.

700,000 units complete

Mr. Wyatt's resignation was seen as the climax to a series of recent events that began with President Truman's recent order (*ENR* Nov. 14, vol. p. 627) removing price controls on the construction industry, and a series of interagency disputes among Wyatt's NHA, CPA, the War Assets Administration, and the Reconstruction Finance Corporation. In accepting the resignation, the President reviewed accomplishments of Mr. Wyatt's program since its induction nearly a year ago (*ENR* Feb. 14, vol. p. 257) and called the achievements "outstanding".

Apparently basing his review and commendation on Mr. Wyatt's final report as NHA administrator (reported elsewhere on this page), Mr. Truman said that about 1,000,000 homes of all types will have been put under construction during 1946, and about 700,000 of these—roughly two-thirds being permanent units—will be completed before the year's end.

In the final press conference at Washington, Mr. Wyatt told newsmen that some very well organized and very vocal opposition, more concerned with its own immediate profits than in the continued success of the Veterans Housing program, could be blamed for his resignation. In amplification of this statement, other government officials commented that the desire of builders to enter the highly profitable $10,000-$30,000 house market motivated demands for removal of all controls.

Mr. Wyatt reiterated that housing continues to be the nation's No. 1 problem, and said that all original housing goals would be met, with the exception of the prefabricated housing program, which admittedly is lagging far behind expectations.

He criticized "producers' and home-building interests" for "short-sighted selfishness that overcame the long-range view of enlightened self-interest".

Small says job is completed

Noting that for the last several months the nation has enjoyed "practically" full employment, and that production has reached or passed previous peaks, Mr. Small asked to be relieved of his duties as head of the agency that succeeded WPB and other groups.

"I do not mean to imply," Mr. Small added, "that all our problems have been overcome. However, once the difficult labor-management problems confronting the country are solved—and I am confident they will be solved—still higher levels of production will pave the way to an even higher standard of living."

He predicted that most of the controls now maintained by CPA would be "out of the picture" in three months, although he suggested that inventory controls be continued beyond that time.

Report sees housing goals reached

Citing peak production of building materials and sharp rises in the rate of completions of housing units over the last six months as evidence of the general success of the veterans' emergency housing program, Wilson W. Wyatt, retiring administrator of the National Housing Agency, last week submitted a final report on his agency's activities.

The report admitted that prefabricated houses—originally expected to produce some 250,000 units of the 1,200,000-house goal set for 1946—had fallen far short of expectations. However, recent guaranteed-market agreements, new priority orders and other moves to obtain materials for prefabricators are expected to improve this feature of the picture in the coming year.

Mr. Wyatt's report, made as of the end of October, indicated that a total of 882,200 housing units of all types had been placed under construction up to that time, and predicted that nearly 180,000 more would be under construction by the end of the year. Of these, some 700,000 units will be completed before Jan. 1, 1947, the report added. About two-thirds of the total figure represents permanent houses and apartments, the remainder being divided among reconversion units, temporary units, trailers, and some few prefabricated units.

Completions rise rapidly

The sharp increase in number of units completed was reflected in a series of charts submitted with the final report, which showed completions mounting from 25,800 in January to 84,300 per month by October, with indications that the rate will continue at about that level for November and December.

Crediting the methods of his administration for the results, Mr. Wyatt said that October production of building materials rose to a high point for the year, and in some materials, such as gypsum board and lath, warm air furnaces and practically all plumbing fixtures, production reached an all-time high.

However, reflecting the lag between the production of building materials and their distribution and use, the report showed that while the amount of construction put under way began to level off as early as May of this year, completions did not hit a peak and show signs of levelling off until September.

Commenting on the general program, Mr. Wyatt cautioned that the problem of providing housing has not yet been solved, and that much work—both in legislative and production fields, remains to be done. He urged passage of the Wagner-Ellender-Taft bill, encouragement of rental housing. He warned of the danger of the home-building industry pricing itself out of the market.

Contractors lose by Supreme Court decision

The Supreme Court on Nov. 25 reversed a judgment of the Court of Claims which had found for the Howard P. Foley Co. against the government for an asserted breach of a construction contract.

The Foley company, an electrical contractor, had agreed for a fixed fee to supply the materials for and install a field lighting system at the National Airport, Gravelly Point, Va., then under construction. The agreement, embodied in a standard form government contract, was that the contractor was to complete, in 120 days, the work of installing certain wiring and lighting fixtures. As a matter of fact, the job was not finished until 277 days after the notice to proceed was given, and the reason for the delay was that the dredging required to build up the airport from under water took longer than the government engineers had anticipated because some of the soil proved too unstable for runways and taxiways and had to be replaced.

The Court of Claims considered that the government had breached its contract by failing to make the runways available in time for the contractor to do his work within the 120 days, but the Supreme Court has now ruled that the government in its contract did not expressly covenant to make the runways available to the electrical contractor at any particular time.

Justices Reed, Frankfurter and Jackson dissented from the majority finding, holding that the decision of the Court of Claims in favor of the contractor should have been affirmed.

Jurisdictional strike threatened in Toronto

Toronto, Ont., is threatened with its first jurisdictional strike in the building industry. William Mills, president and business agent of Local 938 of the International Brotherhood of Teamsters (A.F.L.) has announced that hereafter no ready-mixed concrete will be delivered to any building project in the Toronto area upon which C.I.O. steel erectors are engaged.

Since about 90 percent of all steel erectors there are in the United Steelworkers Union (C.I.O.) this announcement threatens almost a complete tie-up of building work in which steel is involved. The teamsters' union includes in its membership about 250 truck drivers employed by two of Toronto's ready-mix concrete suppliers. It is negotiating for union recognition and raises in pay for the truck drivers with the two companies.

The jurisdictional dispute is a separate issue and is linked with the determination of the United Steelworkers Union to retain steel erectors within its membership. The threatened tie-up would be the first labor trouble to develop in the construction industry in Toronto for many years.

Urge legal action against obstructive labor tactics

Court action to eliminate restrictive labor practices in the construction industry was recommended at a winter meeting of the Prefabricated Home Manufacturers' Institute at Washington, D. C., last week.

Thurman Arnold, former assistant U.S. Attorney General, charged that labor groups are providing major obstacles to the progress of construction by their insistence on "featherbedding" rules and in some cases by collusion with manufacturers and contractors.

"The economy of this country cannot stand labor restrictions on construction," Mr Arnold said. "It must be recognized that labor cannot set up protective tariffs, cannot prevent use of more effective techniques or halt work by jurisdictional disputes."

Pointing out that it is not necessary to crush the labor movement to solve the problem, Mr. Arnold called for a 2-part program, especially tailored for the building industry, in the belief that an industry-by-industry solution is more feasible than any general attack on the labor problem as a whole.

Commenting on the fact that the U.S. Supreme Court—although it has considered several cases hinging on restrictive labor practises—has yet to render an opinion in some of the more significant of these cases, Mr. Arnold called for a series of suits in the various states aimed at obtaining positive high court opinions.

Secondly, he advised a program of education, to make the general public conscious of the price it is forced to pay because of such restrictive labor practices.

Mr. Arnold's talk was the highlight of a 2-day meeting of the group. Other speakers included: Raymond N. Foley, commissioner of the Federal Housing Administration; Tyler S. Rogers, of Toledo, Ohio, president of the Producers' Council and Raymond F. Talbert, of Pittsburgh, Pa., president of the Pittsburgh Home Savings and Loan Association.

A 239-mi. toll highway proposed for Ohio

Construction of a privately-financed 239-mile superhighway across Ohio designed to link up with the Pennsylvania Turnpike, will be called for in a bill to be submitted to the state legislature next month. The J. E. Greiner Co., Baltimore, Md., Pennsylvania Turnpike consulting engineers, said the highway would attract an average of 12,000 vehicles a day. It said a daily maximum of 6,750 vehicles would be adequate to retire in 30 years bonds to the total of $152,380,000, which would be issued to finance the route.

The measure, proposed by Ralph A. Winter, provides for the creation of a 5-member Ohio Turnpike Commission empowered to issue highway bonds containing a statement on their face "that the state of Ohio is not obligated to pay the principal and interest thereon except from tolls." The measure specifies that when the bonds are paid off, the turnpike would be given to the state for its highway system. The proposed route would cross Ohio in the vicinity of Toledo, Cleveland, Akron, and Youngstown.

Submit finance plan for California roads

Suggestions for financing a $2,226,000,000, 10-year highway program for California (*ENR* Nov. 7, vol.p. 609) were contained in a supplementary report submitted to a special state legislature committee on highways last week.

The financial report, prepared by a special committee but based on the general highway program proposed by G. Donald Kennedy, vice president of the Automotive Safety Foundation, estimated that the program as proposed would cost the state between $250,000,000 and $957,000,000 in 10 years, depending on whether federal appropriations for highway improvements continue on the present accelerated basis, or go back to pre-war levels.

To raise this money without placing undue and unfair burdens on the owners and operators of pleasure vehicles, the report suggests that present license fees of $3 per car be continued; that the gasoline tax be raised by from 1 to 1 and ½ cents; that taxes on diesel fuels be raised to a point 50 percent higher than gasoline taxes; and that levies against trucks, truck-trailers and buses be raised on the basis of gross weight and mileage.

See need for road research funds

(*Continued from page* 85)

Michigan planning and traffic division discussed aid to the cities in their planning in more detail, telling how Michigan is helping the cities in that state to plan the streets and express routes for which they are to receive federal-aid highway funds. More data concerning motor traffic within cities are needed he said, before these studies can be completed. Michigan is setting up cooperative projects to collect these data.

Equipment held important

Thomas H. MacDonald, just returned from his trip to Europe made at the request of British and French highway authorities, took as the text for his informal talk to the general meeting a paragraph from a report made by a group of 22 engineers from India who recently spent some time here studying highway building methods. The spokesman for the Indian engineers said that they were going home with a broadened outlook and much better knowledge of how they should approach India's enormous problem of developing an adequate highway system. They also had developed a better appreciation of the importance of research and of the value of mechanical equipment in meeting their problem.

Mr. MacDonald said that without road-building equipment, India and many other countries around the world could not possibly provide the highways that are essential to the higher standards of living that they seek. One of the great services that this country can render to the rest of the world, he added, is to make other countries conscious of the value of mechanical equipment in building an adequate system of highway transport.

Highway research plans

Plans of the Highway Research Board for future work were summarized by Fred Burggraf, associate director, who said that the board was now entering a new period of its existence, with the establishment of the Research Correlation Service (*ENR* Feb. 7, vol. p. 165). The board now has four qualified engineers to head up four of its six divisions and expects to have similarly qualified men soon for the other two.

The board is planning to continue to publish the pamphlets on current road problems that were issued during the war under the general title of "Wartime Road Problems".

Questionnaires sent to the state highway departments asking for opinions on the most urgent problems calling for research brought out the fact that chief interest centers in the supporting value of subgrades, in the design and spacing of joints in pavement, crack fillers, bituminous pavements and soil compaction and soil evaluation methods. The Research Correlation Service will undertake to integrate research in these fields. As a first step, it will compile a bibliography of published material. Ultimately, it may have microfilms of papers and articles.

In answer to questions as to the availability of instruments for reading microfilms, Roy Crum, director of the board, said that such an instrument is available in the National Research Council Building, where the board has its offices, and that most public libraries now have them.

Mr. Crum reported that R. L. Morrison, professor of highway engineering at the University of Michigan had been reelected chairman of the board for 1947, and that F. V. Reagel, engineer of materials, Missouri Highway Department, had been reelected vice chairman. R. H. Baldock, chief engineer of the Oregon Highway Department, was added to the executive committee to serve three years. R. L. Morrison and Stanton Walker were reelected for three-year terms.

The Highway Research Board award for 1946 was made to K. B. Woods, associate professor of highway engineering at Purdue University, H. S. Sweet, also of the Purdue staff, and T. E. Shelburne of the Virginia Highway Department for their joint paper Pavement Blowups Correlated With Sources of Coarse Aggregates.

A further report of the Highway Research Board meeting will be published in next weeks issue.

Amphibian Engineers name Noce president

At a recent meeting in Washington, D. C., the Amphibian Engineer Association was created, a constitution adopted and machinery set up to permit the organization to hold annual meetings. Maj. Gen. Daniel Noce, assistant chief of service of supply, War Department, was elected "National Beachmaster," or the first president of the association.

The society has been created in the interest of national defense and to foster the science of amphibian operations, including the special construction work so generally required in military operations. The new organization will carry out its work through local groups known as beachheads. Any ten individuals eligible to active membership in the association may create a local beachhead. To qualify for membership one must have had military experience with an amphibious group.

Other officers include: Brig. Gen. Arthur G. Trudeau, Chief of the War Department Manpower Board, shore commander or vice-president; Col. Roland C. Brown, chief of the control division of the Office of the Chief of Engineers, treasurer; and Robert A. Lewis, formerly colonel in the U. S. Army and now chief of the planning branch, Plans and Training Division, Office of Chief of Engineers, Secretary.

National headquarters have been established at Washington, D. C. Data pertaining to membership and other information about the new association may be obtained from Mr. Lewis, whose address is P. O. Box 4236, Takoma Park, Washington 12, D. C.

AGC, air group create cooperative committee

The establishment of a joint cooperative committee between the National Association of State Aviation Officials and The Associated General Contractors of America has been agreed upon at a meeting of representatives of both organizations in Washington, and officials of the two groups joined in this statement:

"Passage of the Federal Airport Act authorizes the appropriation of $500,000,000 in federal funds to be matched by local sponsors for a 7-year airport construction program.

"Close cooperation between the officials who will be responsible for the design, preparation of plans, award of contracts, and administration in connection with these airports and the contractors who will do the grading, paving, erection of buildings and installation of necessary utilities is essential if the program is to be carried out efficiently and the public is to receive the maximum in airport construction for the funds invested.

"This joint cooperative committee provides the means through which aviation officials and contractors can obtain a better understanding of their mutual problems, and through which practical suggestions can be developed for improved efficiency and economy in airport construction

"Through this committee the experience of state aviation officials and contractors throughout the country can be brought to focus so that practical means can be developed for perfecting airport construction practices."

ENGINEERING SCHOOL NEWS

Illinois, crowded to capacity, suspends admissions—Two new research labs at Minnesota—New courses and faculty changes

Faced with a probable demand for the entrance of 39,000 students, the president and board of trustees of the University of Illinois have taken steps to curtail the number of students in five colleges and schools, including the college of engineering. The latter is now crowded to capacity and no new students will be admitted there during the second semester of this college year.

There are now 63 Army officers taking engineering work at the university and more will come as soon as new students can be accepted.

The materials laboratory of the University of Washington has developed a quick way of curing concrete, according to Prof. R. G. Hennes. The method was developed by Arthur Owley, a graduate student. Small cement forms were filled with concrete, submerged in water over 150 degrees in temperature and left for an hour and a half, after which they were left in a drying room for one day. The resulting block is as strong as blocks cured for a week by the old method, according to Owley. Although application of the new process to large production has not been developed as yet, it is expected the method may cut buildings costs.

Two new research laboratories for study in sanitary engineering and soil mechanics have been established temporarily in the Oak Street laboratories of the University of Minnesota under the civil engineering department. When crowded conditions on campus have been relieved, the laboratories will be moved to the south portion of the experimental engineering building for permanent quarters, according to Lorenz G. Straub, head of the civil engineering department. The sanitary engineering laboratory, one of 15 now in operation in the United States, will be directed by George J. Schroepfer, professor of sanitary engineering.

Heading the soils mechanics laboratory will be Miles S. Kersten, assistant professor of civil engineering. The chief uses of the laboratory will be in undergraduate instruction and for graduate study and research. Soils mechanics has been added recently to the required courses in civil engineering training.

The civil engineering department of the university has entered into a cooperative research project with the Minnesota Highway Department and the Public Roads Administration for the study of impact on highway bridges, using some of the newer strain gages developed during the war. The first tests will be made upon the bridge spanning the Mississippi River near Fridley. These will be directed by Prof. Joseph A. Wise assisted by Prof. C. A. Hughes of the university staff and T. W. Thomas of the highway department. Mr. Straub will have general supervision over the project for the university.

Modification of pre-engineering courses at North Idaho Teachers College to make them acceptable to accredited engineering schools has been promised following a meeting of faculty members with members of the University of Idaho engineering department. The action was the result of veteran pre-engineering students' complaints that courses taken at NITC were not transferable to the university.

Three or four full time teaching positions are open in the civil engineering department of the school of engineering of The George Washington University. Grades of pay on 10 months annual contract range from $2,400. to $6,000., depending on teaching or industrial experience of the applicant. Those interested should write to Dean of the School of Engineering, George Washington University, Washington 6, D. C.

Charles T. G. Looney has joined the faculty of the Yale University school of engineering as associate professor of civil engineering, going there from the Johns Hopkins University applied physics laboratory at Silver Spring, Md. He continues a consulting relationship with that laboratory. Before the war he was a member of the civil engineering faculty at the State University of Iowa.

Educational and advisement services set up for the Veterans Administration and for applicants for admission will now be available to the general public at Rensselaer Polytechnic Institute. This will include tests and appraisals of ability, aptitudes, achievements and personality, and aid in selecting training programs for indicated occupations.

(*Continued on page* 170)

***New President of Caltech** —Lee Alvin DuBridge, right, former University of Rochester physicist, receives congratulations on his formal inauguration as head of California Institute of Technology from retiring president Robert A. Millikan, center. Karl Compton, president of Massachusetts Institute of Technology, left, principal speaker, in his address noted increasing expense of research, called for "general support" for schools hard hit by heavy taxes on endowments and for a "partnership based on mutual advantage and responsibility" among industry, government and technological institutions. He termed Doctor DuBridge's wartime MIT radiation laboratory illustrative of growing cooperation among the three. Eighteen college and university presidents were among 44 institutional guests attending the inauguration.*

More flood control work to proceed

In addition to the flood control projects listed last week (*ENR* Dec. 5, vol. p. 751) as likely to go ahead now that $55,000,000 of impounded funds for that work has been released, information concerning other such projects has been announced as follows:

The Mississippi valley's proportionate share, amounting to $13,000,000, will enable the Mississippi River Commission to get under way all operations stopped Nov. 1. It is said that after paying off $4,500,000 in unliquidated obligations, it will still have several million with which to operate.

Veteran flood fighters and boatmen of the U. S. Engineer Department will be retained at their posts and a high percentage of the 6,180 employees of the Memphis, Vicksburg and New Orleans districts will be able to keep their jobs. Bank protection work, levee repair and dredging operations will be resumed. Some phases of the work on Grenada and Enid dams in Mississippi will be continued.

The announcement may start engineers on a race against time and weather in their fight to save threatened levees at Francis Bend, above Rosedale, Miss.; at Sunnyside, Miller Bend, and other points in the Memphis and Vicksburg districts.

Remobilization of fleets and personnel by district engineers was ordered by Maj. Gen. Robt. W. Crawford, president of the Mississippi River Commission. The district engineers are Col. B. M. Harlow, Memphis; Col. R. G. Lovett, Vicksburg and Col. L. B. Gallagher, New Orleans.

It may take several weeks to get working parties and equipment back into the field. A policy of urgency was established for Francis Bend, where the river had previously destroyed 6,300 feet of a stretch of main line levee, and where it is now attacking the bank, at a point 900 feet from a $1,544,000 setback levee built in 1940.

Projects in Arkansas

The new turn of events is expected to make possible the completion of Bull Shoals Dam and the levees along the Arkansas and White rivers.

According to announcement in Washington, the increased money will be allocated by district offices of Army Engineers to projects on which contracts had already been awarded when the freeze order on public works was put into effect.

Much work in Pennsylvania

The Conemaugh River Reservoir and a number of other important Pennsylvania flood control projects may be revived. It is said that all such projects in the state now under way or for which contracts have been let will be continued at normal speed.

Mayor David L. Lawrence of Pittsburgh went to Washington to give to the CPA details on the contract status of the Conemaugh undertaking designed as the key to the flood protection of Pittsburgh and the Ohio valley.

It is thought also that now work can be continued on projects at Williamsport, Sunbury, York and Punxsutawney and on all others in which work now is being done or for which contracts had been let prior to the President's limitation order. It is not stated what effect the decision will have on the limitation imposed on money to be spent for flood control planning, but Army Engineers have said there is a chance some planning will be resumed. Among Pennsylvania projects in the planning stage are those in Elk County, Luzerne County, Latrobe, and the Turtle Creek and Allegheny River Reservoirs.

Georgia work to go ahead

Work on Georgia's two multi-million dollar federal hydro-electric, irrigation and flood control projects will move rapidly ahead now that President Truman has released an additional $70,000,000. The Army Engineers will speed work on the $13,400,000 Allatoona Dam, near Cartersville, and by the end of next January expect to get work started on the $45,000,000 Clark's Hill Dam on the Savannah River near Augusta.

Allocation and the amounts set aside for work on projects include:

Allatoona Dam, on Etowah River, near Cartersville, $13,400,000.

Planning for the Chattahoochee-Flint-Apalachicola waterways development, $1,200,000.

Continued work in dredging Savannah Harbor, $800,000.

A survey of the Altamaha-Ocmulgee-Oconee River system for multipurpose development, $349,000.

Col. Peter Feringa, of the Engineers in Washington, said that no specific amount has been set up for Clark's Hill, but at Elberton, Ga., Paul Brown, who represents the 10th Georgia District in Congress, said that President Truman had advised him by telephone that he had released $5,500,000 for this work.

Mile-long power line spans Susquehanna River

Its new electric transmission-line span across the Susquehanna River at Millersburg, Pa., is the longest in the United States, the Pennsylvania Power and Light Co. has announced.

Steel poles imbedded in concrete are terminals for three 5,509-ft. conductors stretching across the river to provide service in the Millersburg area and a 4-county territory west of the span.

Straight-line distance between terminals is 5,366 feet, but the conductors make up the difference in sag as they dip to within 125 ft. of the river. The terminals are atop the edges of the Berry Mountain gorge.

Engineers believe the span is also the longest of its kind in the world.

Wide World Photo

***A 1,500-Quonset Hut Development**—Above is a general view of the largest section of the 1,500 Rodger Young Village Quonset Hut units at Griffith Park, Los Angeles, Calif., which is said to be the largest veterans' emergency housing project of its kind in the United States.*

Electric companies to build big plants

Several announcements have been made concerning large electric power plants to be built by important companies in Massachusetts, Alabama, and Washington. Following are details of some of them.

A new electrical energy producing plant to be built in West Springfield, Mass., for the Western Massachusetts Electric Co. will have boilers five stories high. The plant will cost between $7,000,000 and $10,000,000, according to officials of the company. It will be built by Stone & Webster Co., which has the contract. Construction is expected to continue for the next three years.

Designed to provide electricity for a large section of Western Massachusetts, the new powerhouse will replace the local plant. Borings are now being made by engineers on a 200-acre tract of land to determine the extent of bedrock.

Orders for the boilers, turbines and generators have been placed, but no deliveries are expected, according to company officials, before Jan. 1, 1948. It is estimated that the new plant, when running, will consume 10 carloads of coal daily.

Plans are being drawn for an auxiliary oil-firing system. Oil tanks (with a capacity to permit the plant to run on that fuel for two months) will be buried on the property.

The new plant will be tied in with Western Massachusetts auxiliary plants in Chicopee and Turners Falls.

Big steam plant in Alabama

Alabama Power Co. plans the construction of a multi-million dollar steam electric generating plant at or near Gadsden, Ala. Thomas W. Martin, president, said that the new plant will be laid out for two units with an initial capacity of 120,000 kw. and that construction will go forward as rapidly as plans can be completed, and materials and equipment obtained. He said that the site will be laid out and provisions made for the future installation of additional units.

The new plant will be connected to the transmission system of the company and its operations coordinated with that of the other power sources of the system.

In addition to the new plant the company plans the construction of high-voltage lines and substations. The new plant will be designed to burn both coal and natural gas. Its coal-burning capacity will be about 1,200 tons daily.

It is expected that the first unit will go into operation about the end of 1948 and the second unit about August, 1949. The initial investment in the Gadsden plant will be more than $10,000,000.

Expansion of Skagit River plant

A $240,000 appropriation has been approved by the Seattle, Wash., Board of Public Works to permit the City Light department to carry out field work and prepare plans and specifications for enlarging the Gorge powerhouse at an estimated cost of several million dollars.

The expansion, increasing output 40,000 kw., would double the output of the Gorge plant, according to E. R. Hoffman, City Light Superintendent.

Hoffman declares expansion of the Gorge plant, the city's initial development on the Skagit River, "the logical next step" in the ultimate project planned, pointing out that it can be carried out simultaneously with work on Ross Dam, 14 mi. up the river.

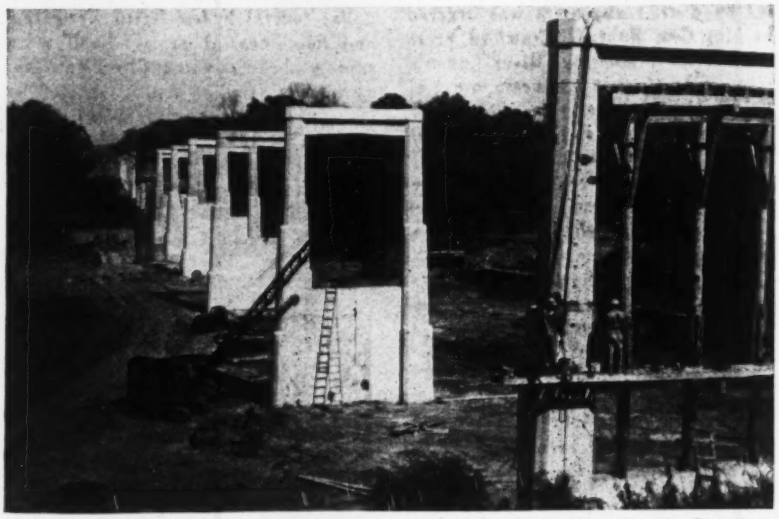
"We will thus gain about two years as compared with proceeding with the construction of a powerhouse at the Ross Dam after that dam has been completed and deferring the Gorge plant enlargement until after the Ross powerhouse has been built," Hoffman said. "Facilities for the work are available at Newhalem, where the Gorge powerhouse is located."

While the completion of Ross Dam in 1948 will greatly augment the water storage on the Skagit River, the generating facilities there are now and will be inadequate, Hoffman says.

Pennsylvania improves 1,145 mi. of roads

In the first half of its current fiscal year, the Pennsylvania highway department has improved 1,145 miles of highway, Ray F. Smock, secretary, reports. Expenditures for highway improvements during October reached the highest monthly figure in more than five years.

During that month the department paid out approximately $6,800,000 for construction, reconstruction, resurfacing and widening.



***Tallest Piers for S. C.**—Highest piers ever built by the South Carolina State Highway Department are being erected to carry a highway bridge over the Congaree River, about 10 miles from Eastover, S. C., on State Route 26. Three piers that will carry a 26-ft. roadway and two 2½-ft. sidewalks across the channel will be 86, 87 and 89 ft. from the bottom of the seal to the top of the pier, and rest on untreated timber piles. Finished grade of the road will be 99.5 ft. above ground level at highest point. The crossing itself will consist of four 4-span continuous plate girder units, with a total length of 1,743 ft. Joseph W. Barnwell Jr., Columbia, and D. M. Rickenbacker, Union, are principal contractors for the foundations, and T. P. Mayes is resident engineer on the job for the highway department. The cost is estimated at about $600,000 at present prices.*

OBITUARY

George Hebard Maxwell, 86, founder of the National Reclamation Association, who campaigned at the turn of the century for the irrigation projects that eventually made the Arizona desert bloom, died Dec. 1 at Phoenix, Ariz. Son of a California pioneer. In 1899 he organized the National Reclamation Association and set out to realize his dream of seeing 1,000,000 acres of Arizona desert under irrigation. He won support of President Theodore Roosevelt, and in 1902 a national reclamation act was passed. In 1903 Mr. Maxwell formed the Salt River Valley Water Users Association and helped bring about construction of the Roosevelt Dam across the Salt River, to make that valley one of the most productive in the United States. The dam was dedicated in 1911.

Mr. Maxwell was executive director of the Pittsburgh Flood Commission from 1908 to 1911.

James Louis Robertson, 86, died in Honolulu, T. H., Nov. 13. He was of Irish birth, but spent his boyhood in Kingston, Ont. In the 1870's he went west and became an active contractor for the Union Pacific and helped to lay the company's tracks outward to the Pacific coast. He went to Hawaii in 1897 and immediately became identified with railroads there, helping to develop the Hilo Railroad and to build highways on all of the Hawaiian Islands.

Willard John Davis, 54, for the last 14 years chief engineer for the Brandeis Machinery & Supply Co., handlers of contractors' and engineering equipment, died Nov. 21, at Louisville, Ky.

David C. Tennant, who retired a year ago as chief engineer for the Ontario division of the Dominion Bridge Co., Limited, died in Toronto Nov. 23. A graduate civil engineer of the University of Toronto, Mr. Tennant spent all his professional life with the Dominion Bridge Co., for 38 years in Montreal and from 1933 until his retirement in 1945 in Toronto.

Carleton Mills Fyler, 50, National Housing Administration expediter in Toledo, Ohio, died Nov. 24. A lieutenant commander in the Seabees, he returned to government service in April after two years in the Pacific. He attended Baldwin-Wallace University, Berea, Ohio, and in 1915 joined the maintenance department of the New York Central Railroad. In 1924 he joined the Toledo bridge engineering department, and six years later became associated with Modjeski, Masters & Chase, engineers. In 1934 he joined Forster, Wernert & Taylor, Toledo consulting engineers, and later was with the G. M. Barton Survey Co. He later had his own engineering firm in Toledo.

Estel D. Rightmire, 76, who resigned three months ago as city engineer of Ventnor, Margate and Longport, N. J., died Nov. 25 at Ventnor.

Francis M. Stallings, 23, of Greensboro, N. C., engineering assistant for the Southern Mapping and Engineering Co. was killed Nov. 26 in an automobile accident near Casper, Wyo., where his firm was constructing a pipeline.

Louis Yager, 69, assistant chief engineer of the Northern Pacific Railway, died at St. Paul, Minn., Nov. 22. A graduate of the University of Minnesota, he had been with the railway for 46 years. After the first world war he went to Washington as chief maintenance-of-way engineer of the U. S. Railroad Administration.

Godfrey Swenson, 70, who was called the builder of the skyline of Kansas City, Mo., in which city he was a contractor for 50 years, died there Nov. 19.

William J. DeWolfe, 73, died at Halifax, N. S., Nov. 24. Born in Halifax, he became a civil engineer with the Halifax & South Western Railway. After several years, he went to western Canada with the Grand Trunk Railway. He went back to Halifax in 1917, and joined the city engineering staff. He was there for 21 years and was assistant city engineer when he retired.

MAJOR MEETINGS

Association of Professional Engineers of Ontario, 25th annual convention, Royal York Hotel, Toronto, Canada, Jan. 17-18, 1947.

American Association of State Highway Officials, annual meeting, Biltmore Hotel, Los Angeles, Calif., Dec. 17-20.

American Society of Civil Engineers, annual meeting, Commodore Hotel, New York, N. Y., Jan. 15-18.

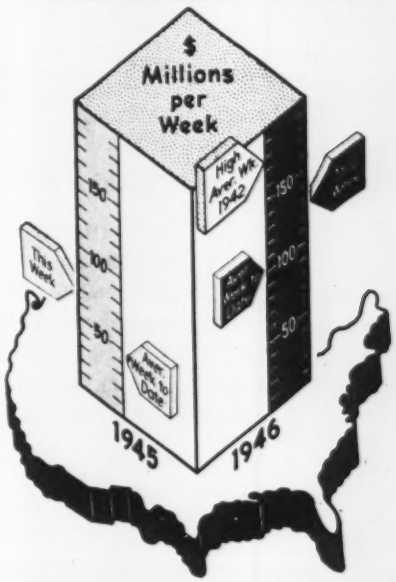
Associated General Contractors, annual convention, Stevens Hotel, Chicago, Ill., Jan. 27-30.

Canadian Construction Association, 28th annual convention, Niagara Falls, Ont., Jan. 14-16.

National Crushed Stone Association, annual meeting, Edgewater Beach Hotel, Chicago, Ill., Jan. 27-29.

Associated Equipment Distributors, 28th annual meeting, Edgewater Beach Hotel, Chicago, Ill., Feb. 13-15, 1947.

CONSTRUCTION ACTIVITY



As Reported this week to . . .
Engineering News-Record

CONTRACT VOLUME

Continental U. S. Only (Thousands of Dollars)

	Week of Dec. 12 1946	Cumulative 1946 (50 wks.)	Cumulative 1945 (50 wks.)
Federal	$792	$619,702	$742,456
State & Mun.	22,398	1,373,846	381,669
Total Public	$23,190	$1,993,548	$1,124,125
Total Private	103,741	3,086,214	1,075,257
U. S. Total	**$126,931**	**$5,079,762**	**$2,199,382**

WHERE CONSTRUCTION ACTIVITY ORIGINATED THIS WEEK

Dollar Volume (Thousands)

Type of Work	This Week	Cumulative 1946 (50 wks.)	Cumulative 1945 (50 wks.)
Waterworks	$3,497	$106,331	$60,048
Sewerage	2,669	111,196	33,244
Bridges	2,047	125,507	45,399
Highways	4,600	749,959	221,435
Earthwork, Waterways	5,234	349,381	56,151
Buildings, Public	4,819	400,694	460,076
Industrial	72,042	1,066,700	606,865
Commercial	22,926	1,824,940	351,645
Unclassified	9,097	345,054	364,519

NOTE: Minimum size projects included are: Waterworks and waterway projects, $22,500; other public works, $40,000; industrial buildings, $55,000; other buildings, $205,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1946 (50 wks.)	Cumulative 1945 (50 wks.)
NON-FEDERAL	$1,594,007	$718,033
Corporate Securities	590,868	191,111
State and Municipal	778,139	363,322
RFC Loans	.....	24,600
REA Loans	.....	60,000
Fed. Aid Highway	225,000	79,000
FEDERAL	1,672,982	1,049,898
Total Capital	**$3,266,989**	**$1,767,931**

ENR INDEX NUMBERS

Index Base=100		1913	1926
Construction Cost	Dec. '46	368.10	176.95
Building Cost	Dec. '46	278.49	150.54
Volume	Nov. '46	164	72

EDITORIALS

VOLUME 137 NUMBER 24

December 12, 1946

What Next for Housing?

RESIGNATION of Wilson Wyatt as Veterans Emergency Housing Expediter and National Housing Administrator gives a new complexion to the housing picture. From the beginning, Mr. Wyatt adhered to a theory that emergency measures and long-term housing objectives can be and must be integrated. A capable, honest administrator, with a balanced viewpoint between business and politics, he worked hard and sincerely to attain these objectives. But however much one might have wished that such efficiency and order could be achieved, it was not a practical reality. Pushing the long-term objectives stimulated unnecessary opposition to the whole housing program. Material shortages and black market prices complicated the emergency program further. Evidently the President believes that some reorientation of policy is necessary. There are several alternatives. Material priorities for veterans housing can be maintained and strengthened. The prefab program can be pushed with greater vigor. Special aid can be granted large rental housing projects. Or all controls and directives can be canceled and the construction industry permitted to function without restriction. One or a combination of several of such alternatives might be compounded into a workable housing policy. In our opinion, special aid for large rental housing projects appears to have the greatest possibilities for providing quickly the type of housing veterans can afford.

Better Public Works Practice

NOT THE MOST SPECTACULAR, but certainly one of the most interesting, postwar developments in the public works field is receiving successful demonstration in the metropolitan New York area. The activity is one concerned with the exchange of experiences, and represents an effort of the New York-New Jersey chapter of the American Public Works Association to help its members do a better job. As described on p. 758 of the Dec. 5 issue, the program calls for four meetings a year at different towns in the area where an afternoon is spent in studying public works practices, particularly in the use of equipment. Aside from the obvious good that results from this method of stimulating interest in new ways of doing things, there are other dividends to the towns whose representatives participate. Not the least of these is the encouragement given to broadened professional contacts. Such contacts not only facilitate exchange of information but also pave the way for mutual aid in times of equipment breakdown or other emergencies. Expenses are small compared to the benefits derived, hence there is much to commend wider adoption of the New York-New Jersey APWA program in other regions of the country.

Crane Boom Electrocutions

ONCE MORE we have reported a tragic construction accident under the all-too-familiar head "Crane Boom Hits Power Line." (*ENR* Dec. 5, vol. p. 764). This time four men were electrocuted and several more were injured. Certain accidents may be unforseeable, but not those of this type. Power lines are out in the open, where they can be seen readily, and they are known to be carrying lethal charges. Speaking generally, management cannot escape blame for such accidents by charging them to individual carelessness because it should be possible to prevent them by simple vigilance and eternally drilling into the minds of supervisors and workmen alike the hazards of transmission lines. Frequent safety campaigns are the only checks on human forgetfulness and carelessness. Also, shielding booms with an insulating shell is not too much trouble or expense when cranes are working around high-tension wires, for here human life is at stake.

Hidden Costs in Contracts

THREE JUSTICES of the Supreme Court disagreed with the majority in a decision denying to a contractor recovery of added costs incurred due to his being forced to keep part of his force on a job for 277 days because of delays over which the contractor had no control although the government had specified in the contract that his work should be completed in 120 days. Details of the decision are given or page 772 of this issue. The Court of Claims had rendered a decision in favor of the contractor, which now has been reversed by the Supreme Court, for reasons that the majority consider sound. In the light of the interpretation put on this contract by the majority, bidders on work covered by similarly loosely written contracts

will quite logically increase the contingencies item in their bids to protect themselves against similar delays that are beyond their control. Consequently, in the future, there will be greater need for engineers who write government contracts to make certain that those contracts are written with such clarity as to eliminate hidden costs of this kind.

Deep Foundations at Chicago

ANOTHER STEP in meeting the foundation problems presented by the deep clay beds underlying Chicago was reported in the November 28 issue of *ENR* (vol. p. 722). Step-tapered pipe piles to support the heavy loading called for in a big printing plant have been driven to a maximum penetration of 82 ft. to reach rock or hardpan overlying the rock. This is a notable departure from the normal Chicago practice of sinking shafts to rock and filling them with concrete.

Chicago foundations have an interesting history. Until about 1880, Chicago was a city of woodpile foundations. The larger and heavier buildings were pile supported almost without exception. Most of these foundations stood up well; some gave trouble and a few failed. The failures were examples of individual misjudgment in design. For the building sizes and weights of that time, these foundations of friction piles did the job.

With the advent of the tall buildings in the Eighties, two types of foundations came into use and held on until the late Nineties. One type consisted of wood piles driven a few feet apart over all the building area and capped with an over-all slab of concrete. The other type consisted of individual footings for one or two columns composed of grillages of I-beams or railway rails embedded in concrete. These foundations carried and still carry the Monadnock, Old Colony, Fisher, Fair, Rookery and several other buildings erected prior to 1900. The spread foundation, either overall or individual, for the buildings of this period was a success.

For the taller and heavier buildings to come, it was realized from the first that a stronger foundation was needed. In the early 1900's this developed in the curbed well or shaft sunk to bedrock and filled with concrete. These shafts made it possible to reach firm foundations far below the limit of wooden piles and made greater load concentrations possible.

Meanwhile, in other parts of the country, efforts to improve on the wood pile as a support for increasingly heavier buildings resulted in development of precast or cast-in-place concrete piles of various types, tubular steel piles and H-section steel piles. Progressively, these types of piles have been improved and the depths to which they can be used with full confidence have been increased.

Use of a combination of pipe piles and step-tapered concrete piles for the Donnelley printing plant in Chicago marks the first application of these newer pile developments to the Chicago region on a major scale. Therefore, the results of this undertaking will be watched with interest. It is to be hoped that information as to costs and speed of construction will be made available, for, presumably, it is in the area of costs and speed that this newer method must compete with the shaft method that has given such uniform satisfaction in Chicago.

It may be thought provoking to observe that at least one further step in foundation design is open to Chicago builders if it can show economies over current methods. It is the one suggested by Karl Terzaghi for the deep clays of New Orleans. In his report on settlement of the Charity Hospital, Mr. Terzaghi suggested the excavation of a basement of sufficient depth that the weight of excavated material offsets the superimposed building weight to the extent necessary to prevent consolidation of the deep underlying soil. This procedure was, in fact, successfully used for the Loteria Nacional Building recently completed in Mexico City.

However, it should be noted that perfection of the deep-pile foundation method used for the Donnelley building may have made the Terzaghi proposal less practical for regions like Chicago where firm rock is not too far below the surface. Nevertheless, there remains the possibility that foundations designed for Chicago and for similar conditions elsewhere might be made simpler and less costly by application of the principles set forth by Terzaghi to foundation areas where the loading is not so concentrated as to call for support on the underlying rock. The Donnelley pile job, in any event, reopens the subject of deep foundations to new trains of thought and new possibilities.

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WALDO G. BOWMAN, *Editor*, EDWARD J. CLEARY, *Executive Editor*.
New York: V. T. BOUGHTON, R. K. TOMLIN, H. W. HUNT, E. E. HALMOS, JR., T. D. MacGREGOR, H. P. ORLAND and F. S. MERRITT
Chicago: V. B. SMITH, J. R. CARR, *Washington:* A. N. CARTER, *San Francisco:* N. A. BOWERS, L. L. WISE
EDITORIAL OFFICES: 330 WEST FORTY-SECOND STREET, NEW YORK, N. Y.

Fig. 1. Where long hauls were required, the material was raised into large bottom-dump wagons with a plow-type loader.

Moving 178,000 Cu. Yd. of Earth Monthly For the Shirley Highway

***Contents in Brief**—Grading for an extension of the Shirley Highway in Virginia was carried out at a high rate by use of a new type of elevating loader and 13-cu. yd. bottom-dump wagons on the long-haul work and by means of carrying scrapers where short hauls were permissible. Following this procedure, a 45-man crew was able to move 8,000 cu. yd. in a single day and attained a total of 230,000 cu. yd. in one month.*

ON AN EXTENSION of the Shirley Memorial Highway southwest of Washington, D. C., the grading contractor succeeded in moving around 230,000 cu. yd. of materials during two months and averaged nearly 180,000 cu. yd. during the 5½ months required for the bulk of the earth-moving operation, despite much bad weather in May, a shortage of skilled labor, and the difficulty of getting new equipment and repair parts.

The new expressway is the first controlled-access road built by the Virginia Department of Highways and has been named the Shirley Memorial Highway in honor of the late Henry G. Shirley, who died in 1941 after serving 19 years as highway commissioner of Virginia. It starts in the vicinity of the Pentagon Building across the Potomac River from Washington and extends southwestward on a location that bypasses the city of Alexandria.

The highway is designed for a speed of 70 mph. and the layout is characterized as a "spline-line" design, which was described in detail in the *ENR* Dec. 6, 1945, vol. p. 754. Two 24-ft. wide reinforced concrete pavements are provided. Later, if desired, one additional lane each way can be added for the first five miles at the Washington end. The roadways will be separated by a grassed median strip 14 to 70 ft. wide, the minimum width of the right-of-way being 300 ft.

Construction of the Shirley Highway was begun during the war when the Public Roads Administration built a 2.2-mile section as part of the highway network in the vicinity of the Pentagon Building. Last fall, the Virginia department awarded a $497,000 contract for the grading and construction of the few small drainage structures required for 6.8 miles of a 14.6-mile extension of the highway to Occoquan Creek, from where a four-lane highway is available all the way to Richmond.

The highway traverses rolling country with the predominate soil type clay-gravel of the A-1 to A-3 classifications of the PRA. The cuts averaged from 15 to 18 ft. in depth but one was 100 ft. deep requiring 200,000 cu. yd. of excavation. The length of haul varied from a few hundred feet to over a mile, with the average about 2,000 ft.

New type loader employed

To meet this type of problem the general contractor assembled two groups of equipment, one for the short-haul work and another for the long-haul operations. Equipment gathered for the long-haul work included a high-capacity side-loading elevating loader (Fig. 1) of a new type only recently placed on the

market by the Euclid Road Machinery Co. Although the loader is designed to excavate to a maximum width of 9 ft. on the finishing operation, on the work being described the general procedure was to cut a strip about 3 ft. wide and about 18 in. deep. The excavated material is transported on a belt 54 in. wide rising to a loader chute under which there is a clearance of 10 ft. for the movement of trucks. The unit is equipped with a 150-hp. diesel engine that operates the belt and the hydraulic hoists used to control the position of the cutting point of the grader. A 110-hp. tractor was employed to pull the loader, the operator of the tractor also operating the loader.

Other equipment used for the long-haul operation included: Twelve 13-cu. yd. bottom-dump wagons for the hauling work, a tractor-drawn rooter used for scarifying the material ahead of the elevating grader, one 12-ft. patrol grader employed for shaping the banks of the cuts, a 110-hp. bulldozer assisting in shaping the banks and keeping the cut "in shape" for the hauling equipment, a second bulldozer for spreading the material on fills, and a tractor-drawn sheepsfoot roller employed on compaction of the fills. When convenient, one of the wagons or a bulldozer was used as a "pusher" for the loader, which increased production by about 10 percent.

Experience in using the loader assisted by the equipment just listed revealed that the width of cut had to be at least 30 ft. to permit the long-haul equipment to operate effectively. It was also shown that the equipment offered the greatest advantage on long cuts of 500 ft. Under average conditions it was possible to load the 13-yd. wagons at the rate of about one a minute; in one 11-hr. day, 682 wagons were loaded.

Pans used for short hauls

For the short-haul operations the contractor elected to use four 12-cu. yd. carrying scrapers each pulled by a 110-hp. tractor. Additional equipment used on the short-haul operations consisted of three 110-hp. bulldozers, including one working as a pusher much of the time, a 12-ft. patrol grader, a tractor-drawn rooter, and a tractor-drawn sheepsfoot roller.

Other equipment employed on the general grading operations and shifted from the long-haul to the short-haul work as needed included four trucks and one $\frac{3}{4}$-cu. yd. combination crane and dragline.

Fills carefully compacted

In constructing the fills the material was put down in 8-in. layers, compaction being continued until the density was 95 percent of that at optimum moisture content. The traffic of the rubber-tired hauling equipment proved an important factor in this work. Fortunately, the moisture content of the material as spread was sufficient so that no water had to be added. This fact, in combination with the effective action of the hauling equipment, permitted the compaction to be completed with only a few passages of the sheepsfoot rollers. Rollers were generally used as two three-roller units pulled in tandem.

The general practice was to work

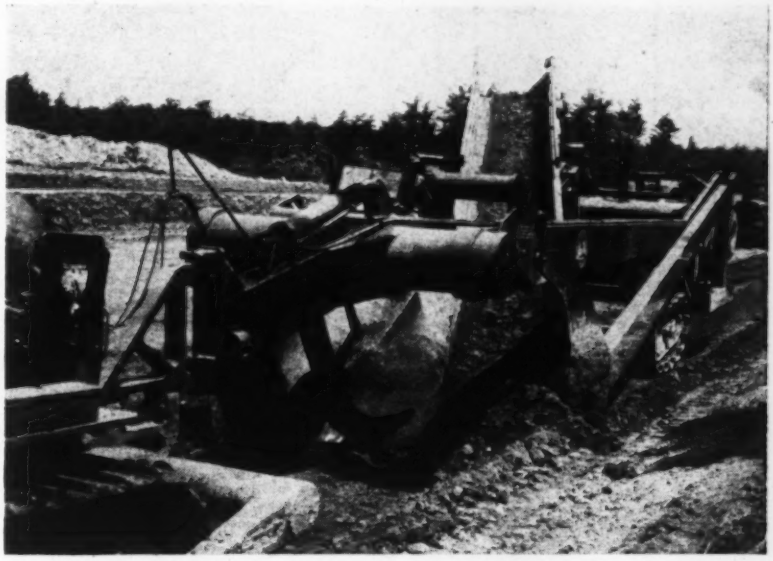


Fig. 2. Normally the new type loader was used to excavate to a width of about 3 ft. and a depth of 18 in. The depth of cut is regulated by the hydraulic piston shown above the hitch connecting the loader to the tractor. The belt is operated by a 150-hp. diesel engine mounted at the rear end of the loader.

Fig. 3. In the clay-sandy soil encountered on the Shirley Highway a rooter preceded the elevating grader to permit the loader to be pulled more easily.

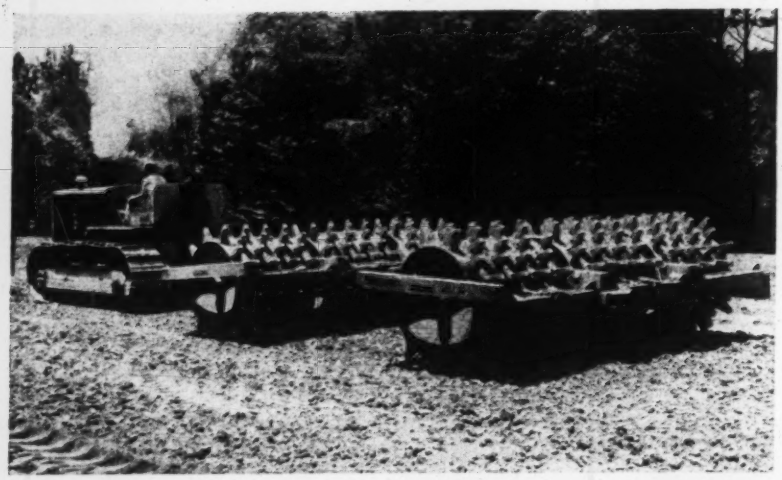


Fig. 4. Travel of the pneumatic-tired hauling equipment did much of the compaction work, but for each of the 8-in. layers this traffic had to be supplemented by a few trips of sheepsfoot rollers.

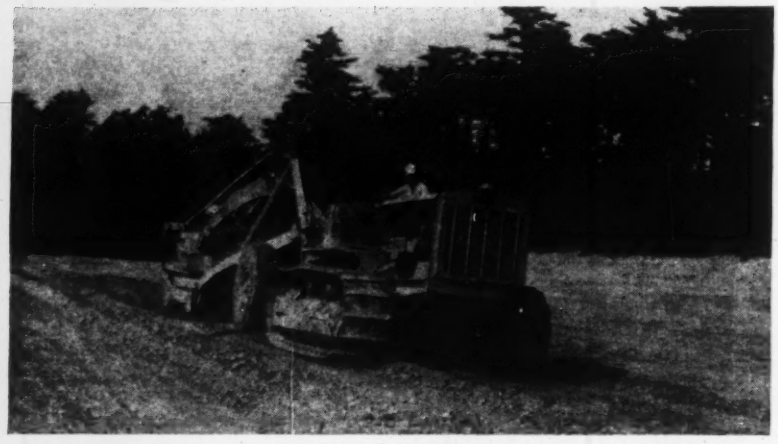


Fig. 5. On short hauls and in finishing operations the contractor chose to use carrying scrapers for the hauling work.

10-hr. per day six days a week with a total crew of about 45 men, the number of hours being increased to eleven in the summer months. With the equipment listed, this crew was able to move as much as 230,000 cu. yd. in one month and as much as 8,000 cu. yd. in a single day. Grading was begun March 4 and between then and Aug. 20 a total of 981,000 cu. yd. was placed in the fills.

Period	Work done, cu. yd.
March 4 to March 20	76,000
March 20 to April 20	228,000
April 20 to May 20	137,000
May 20 to June 20	195,000
June 20 to July 20	234,000
July 20 to Aug. 20	111,000
Total; 5½ months	981,000 cu. yd.

The figure for April 20 to May 20 is low because several days were lost early in May due to severe rainy weather, while that for July 20 to Aug. 20 is low because operations had begun to taper off and some equipment was idle. The monthly average for the total period indicated is 178,000 cu. yd.

The $497,000 grading contract was held by the Nello L. Teer Co., Durham, N. C., the price per cubic yard for regular excavation being 28.5 c. For the Teer firm, W. R. Burton, was superintendent and John W. Hanner, resident engineer. Construction of the three small drainage structures required as part of that firm's contract was sublet to Bowers Construction Co., Raleigh, N. C.

For the Virginia Department, C. S. Mullen is chief engineer, T. F. Loughborough, construction engineer. J. H. Phillips, resident engineer, and E. F. LaPrade, project engineer.

For the Public Roads Administration, which aided in the financing of the work, C. E. Swain is division engineer of Division 2, M. B. Kinnikin, district engineer for the state of Virginia, and George W. Hoffman is area engineer.

Two West Virginia Cities Will Operate Garages

Two U. S. cities now are building municipally-financed and operated parking garages, first of their kind in the country according to the American Public Works Association. The cities are Wheeling and Bluefield, W. Va.

The Wheeling municipal garage will be a 3-deck 700-auto capacity building in the downtown business district and will be financed by self-liquidating bonds. The Bluefield 800-car garage, on which construction already has begun, is slated for completion by late 1947. The $397,000 structure has four floors for parking, including the roof, and is being financed by $450,000 of revenue bonds. The tentative plan of operation and schedule of parking charges, it is claimed, would pay for the project in 20 years, with a sizable surplus.

Bluefield, a city of 25,000, located on the side of a valley, has practically no flat land, and very little vacant space for parking. As it is the center of a trading territory of 300,000 people, Bluefield has a serious parking problem. Recently the city bought 46,000 sq. ft. of land at a strategic spot, paying $114,000 for it, and in this location will erect the 5-story reinforced concrete garage. The contractor is C. L. Lewis of Lynchburg, Va., and the designer Alex B. Mahood of Bluefield.

San Francisco, Calif., and other cities have built parking garages with city money but have turned them over to private concessionaires for operation. Detroit, Los Angeles and Philadelphia also have planned garages on that basis. The two West Virginia cities, however, will operate their garages as direct revenue-producing municipal services.

Spillway Energy Dissipated On the Face of a Dam

***Editor's Note**—Flood flow over the spillway of a high dam possesses at the end of its fall a tremendous amount of energy that tends to be expended in undercutting at the toe, endangering the dam. On the Loskop and Vaalbank dams in South Africa, a device known as a "splitter" successfully reduces erosion damage to a negligible amount by spreading this destructive energy over a large area. In a paper, "The Dissipation of the Energy of a Flood Passing over a High Dam," read before the South African Society of Civil Engineers in July, 1943, D. F. Roberts, construction engineer, Irrigation Department, Pretoria, South Africa, described model studies and investigations that led to the development of the splitters and explained how, according to the model studies, the device acts to dissipate flood energy. A description of the splitters and their action, based on data in Mr. Roberts' paper, is given.*

DISSIPATION of the impact and scouring force of flood water topping the Loskop and Vaalbank dams in South Africa is accomplished by a row of bracket-like projections along the down-stream faces just below the crests. The device was first worked out, from experiments on models, for the Loskop Dam and the illustrations and description that follow relate to that dam particularly. This is a notably handsome structure in a beautiful location as shown by Fig. 1. Fig. 2 is a nearer view along the overflow section showing the row of bracket projections, or "splitters" as they are called by the designer, because of their action on the overflow sheet of water.

Loskop Dam

Loskop Dam is an overflow structure, with a spillway 800 ft. long and 110 ft. above the river bed. To provide for future raising, the section, Fig. 3, was made thicker than the constructed height required. The extra thickness, on the downstream face, was carried up to a point near the crest and then reduced by a 6-ft. horizontal step to the correct section. Because of the step, a flood passing over the crest would be thrown clear of the dam and would strike the apron 80 or 90 ft. below in a more or less vertical direction.

The maximum anticipated flood is 100,000 cfs., and it was calculated

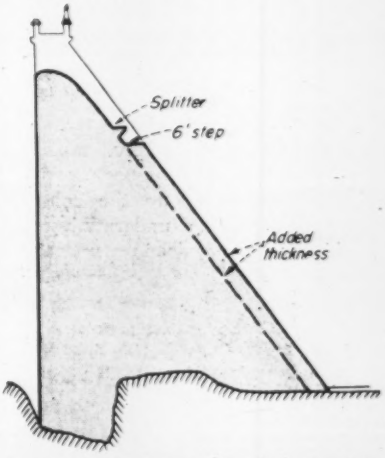


Fig. 3. Section of Loskop dam showing added thickness for future increase in height and location of the step and splitters used to spread the overflow.

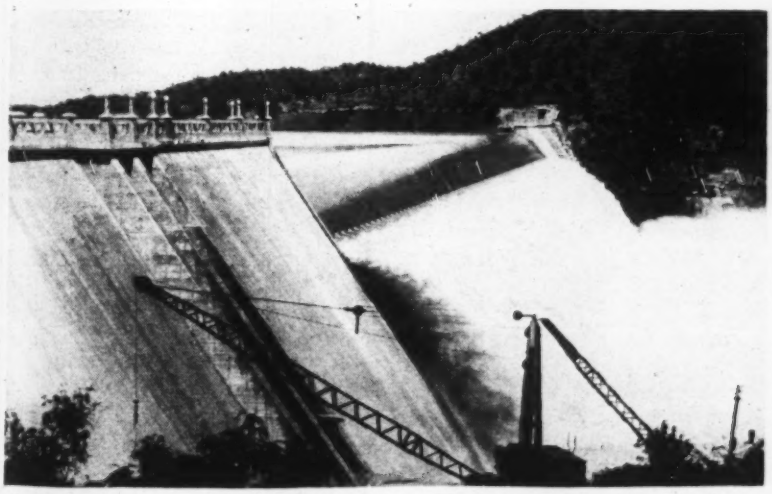


Fig. 1. Loskop Dam, South Africa, with a flood flow topping its 800 ft. spillway. "Splitters" cut the sheet of flowing water before it strikes the 6-ft. wide step on the face of the spillway to dissipate flood energy.

Fig. 2. Bracket-like projections, called splitters, located below the crest, break up flood flow and spread it widely.

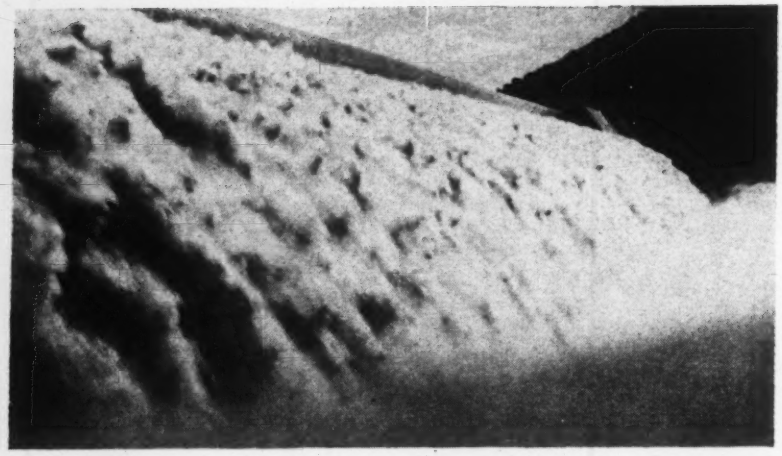


Fig. 4. Spreading action of splitters on the solid overflow stream of a 4-ft. flood at Loskop Dam forms foaming, air-entrained mass.

that the energy generated by this flood falling 100 ft. would be about 1,000,000 hp. or 1,250 hp. per foot of spillway. The flood stream, if undisturbed, it was considered, might be so concentrated as to endanger the dam by breaking up the concrete apron and finally undermining the dam unless a very deep water cushion were provided. Speculation as to a dam section without the step is not pertinent. The section shown, with the step, was the one that had to be considered. The problem was to break up the overflow stream at the top and spread it over as large an area of apron as possible, thus avoiding the necessity of a very expensive water cushion. The splitters shown by Fig. 2, do break up and spread the overflow stream from a fairly solid sheet of water into the foaming, air-entrained mass shown by Fig. 4. The theory and action are explained later.

Structural dimensions of the splitters at Loskop dam are not given in the paper by Mr. Roberts; their length, width and spacing were determined from tests made with small models that are described at length in the paper, including the development of certain general design formulas, tables and charts. The tests and discussion are omitted here. Space permits only a statement of the splitter theory and action and such few details of actual application as the paper furnishes.

Description of splitters

As shown by the illustrations, each splitter is a wedge of concrete with its base set into the face of the dam. The top of the wedge is horizontal and is bound with angle iron to keep the edges sharp. Structurally the splitters present no difficulties. At Loskop about 100 splitters were used in a spillway length of 800 ft. The center to center spacing of the splitters is then about 8 ft. The space or opening between splitters is about one-fourth greater than the width of a splitter. These are rough estimates.

Incidentally, referring to the Loskop design, Mr. Roberts in his paper says, "It may be asked: Why not avoid the step in the dam, allow the flood to flow down the faces and destroy the energy in one of the ways devised in the past, such as baffle piers or by making use of the hydraulic jump?" He went on to say that the records of baffle piers "are not very convincing of the efficiency of the method." To use a hydraulic jump, a depth of about 20 ft. of water would be required necessitating an expensive subsidiary weir and apron. But, whatever it might have been, the design called for a step and this was, as already stated, the condition that had to be met.

Theory and action

The assumption started with is that a small stream of water at high velocity breaks up and frets away into drops and spray quicker than does a large stream. The thought was to find a means, somewhere above the step in the face of the dam, that would split the single overflow stream into many small streams. The device must be one that would cause the split streams to break up and scatter uniformly. The device should not throw the scattered streams too far downstream, as this would increase the size and cost of the apron; it should however throw the stream clear of the dam, as otherwise the water would collect on the slope and set up the same problem again lower down. Search for a device was undertaken by tests with a model. The one finally arrived at was that shown by the illustrations and previously described.

As determined by the tests and observed later at the dams in flood, the action of the splitters is diagramed by Fig. 5. As the overflow (main stream) strikes the line of

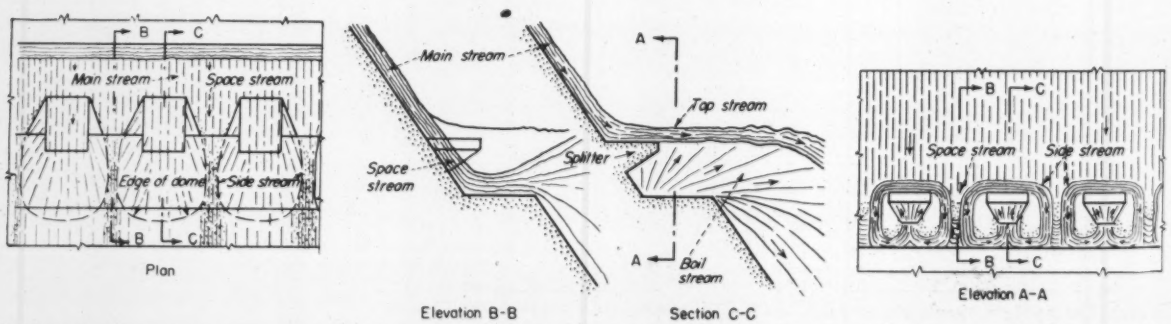


Fig. 5. Action of splitters and steps in breaking up solid overflow stream and dissipating it into spray and foam as shown by Fig. 4 and 6. The boil streams and top streams intersect to form a dome-shaped boil and decompose the space streams.

splitters it is divided. One part flows over the splitters forming top and side streams and another part flows between the splitters forming the space streams. The space stream contracts, grows narrower, as it crosses the step and consequently becomes deeper. This action of the space stream is quite smooth, there is no disturbance and the water is quite clear. The side streams exhibit a similarly distinctive behavior. The water that flows over the sides of a splitter does not combine with the space streams; the side streams remain separate, converge at the end of the splitter and combine to form the boil stream. The flow of the boil stream is much disturbed and is upward and outward until it hits the top stream.

These phenomena of stream action are not clearly explained. They were observed repeatedly in the model tests and so far as can be seen exist at the dam in flood. When the boil stream strikes the top stream both streams break up into a dome-shaped, turbulent mass of foam called the boil. With proper head and spacing of the splitters, the domes expand laterally until they intersect and break up the unstable space streams. The concluding result is the cataract of foam and spray shown by Fig. 4.

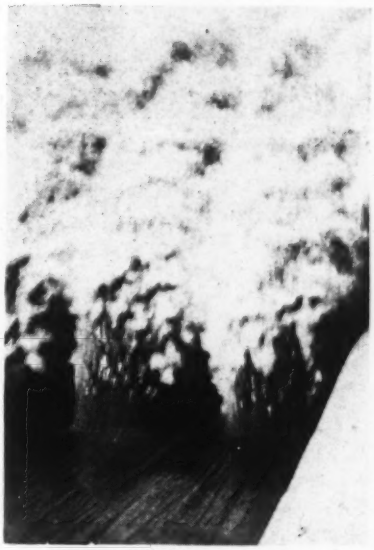


Fig. 6. View looking down the slope of the spillway showing the solid overflow stream passing over and between the splitters.

The drawings of Fig. 5 diagram the stream actions clearly. Fig. 1 is an end view of the overflow water as it leaves the step, and Fig. 7 is a view looking down from the crest and showing the split-up of the smooth overflow stream into space streams, top streams and side streams. A number of views are shown as the best evidence of the successful results at Loskop Dam of crest dissipation of flood-water energy at overflow dams.

The information for this article is from photographs and a copy of a paper, before referred to, by D. F. Roberts, construction engineer, Loskop Dam. Permission to carry out the experiments at Loskop Dam was granted by the late Director of Irrigation, A. D. Lewis, and permission to publish the results was given by the present director, T. Hopwood. Valuable assistance in this work was furnished by H. A. E. Bock.

Ground Water Pollution in California Points to Industrial Waste Discharges

The effect of industrial wastes on groundwater supplies in southern California was discussed by Byron E. Doll, deputy city engineer, Huntington Park, Calif. at the recent annual convention of the California Section of the American Water Works Association.

Mr. Doll stated that the aqueducts bringing water to southern California cities from Owens Valley and from the Colorado River, are such huge construction projects that they have diverted attention from the fact that groundwater is still the largest and most important source of supply in southern California. Aquifers and underground basins in this area are almost unbelievably large. Computations have indicated that to fill them would require the combined flow of the Owens Valley and Colorado River aqueducts for a five year period. Not only conservation but also protection of this great supply is of vital importance to industry, agriculture and the general public.

In Los Angeles County a population of 3,400,000 is concentrated in an area where more than 10,000 industrial developments are producing wastes, both acid and alkali, of wide variety. Among these wastes are phenols from plastics manufacturing plants, heavy metals including hexavalent chromium, greasy wastes from tanneries, packing plants and wool-processing plants, saline and oily wastes from oil wells or refineries, as well as wastes from soap and paint factories, breweries, paper mills, gas plants and butadiene plants.

Pollution charged to sewer overflow

In some localities sewers are so overloaded that wastes overflow and escape into the soils; in other areas, because of overloaded sewers, local officials have required that wastes be discharged into sumps, washes, arroyos or wells.

In the now widely cited "Montebello incident" the wastes from a weed killer plant, commonly known as 2-4-D, were discharged into the sewers of the city of Alhambra. After passing through a sewage treatment plant the wastes were discharged into the Rio Hondo River about a mile upstream from the overflow from a subterranean basin. Within a short time eleven wells serving 25,000 people were so seriously affected that even after cutting off the source of contamination, large expenditures were necessary for treating the affected water in order to make it potable again.

While the laws of dispersion and dilution for surface waters are well known, little is known of such movements underground. Fortunately, the low velocities and the lack of turbulence in underground flow limit the dispersal of pollution and cause it to travel in a narrow band with little dilution. Such flows therefore, affect only wells directly in the path of flow.

Underground pollution may not come to light for years; sources are extremely difficult to trace and even when located and stopped it may be many years before the basin will again be usable. Some basins have been permanently ruined, concluded Mr. Doll.

The Birth of Mechanized Construction

C. S. Hill
Associate Editor (Retired), Engineering News-Record
Long Branch, N. J.

***Editor's Note**—These observations of a veteran editor are of value in giving construction men of today a better point from which to view the broad picture of construction developments in recent decades. Without such perspective few can appreciate how unprecedented is the progress made during the lifetime of many of us, not only in construction machines themselves but also in coordination of the operation of various types of such machines on a construction job. These developments are among the major contributions of the construction industry to human progress.*

RECENTLY I have been reading two books, each the career-story of a great builder of engineering works. They are: "Sixty Years a Builder" by Henry Ericsson and "Brawn and Brains" by Franklin Remington. Omitting the early years of getting fixed in their life occupation, the histories of these two men covered about the same period of time—the fifty years or more from the late Eighties to nearly the present decade. In those fifty years engineer builders have made construction a dominant feature in the world's material development.

It was my fortune to have some part in recording the construction history of this half century. It was in 1888 that I began writing construction news as a cub reporter on *Engineering News* and in 1940 that I retired from active editorial work on *Engineering News-Record*. In that time most of the construction developments told of in the books named were subjects of editorial attention and many of them were subjects for my editor-reporter pen.

But these books, as well as many other modern writings, omit mention of a construction development that is as much a product of the period as are any of the ambitious promotional plans or great engineering structures mentioned in them. This is the birth in 1885-1895 of mechanized construction.

As I think back to that time I wonder if we as engineer builders fully realize the marvel then born that has come about in the use of machinery in construction. Do we realize that no mechanization of the factory excels for its purpose that in the construction field; that no assembly line in industry surpasses the trains of machines, often continuous for miles, whose operations mesh so perfectly to produce a concrete road or a Tennessee River dam? Indeed it takes thought to realize how great the accomplishment is.

Mechanization in this sense means more than to provide with machinery; it fulfills this definition: *Mechanization is the calculated combination and coordination of machines in train to carry out a succession of processes constituting a construction operation.* This is quite a different accomplishment than "to provide with machinery." Construction has always provided itself with machinery—such as was available at the time.

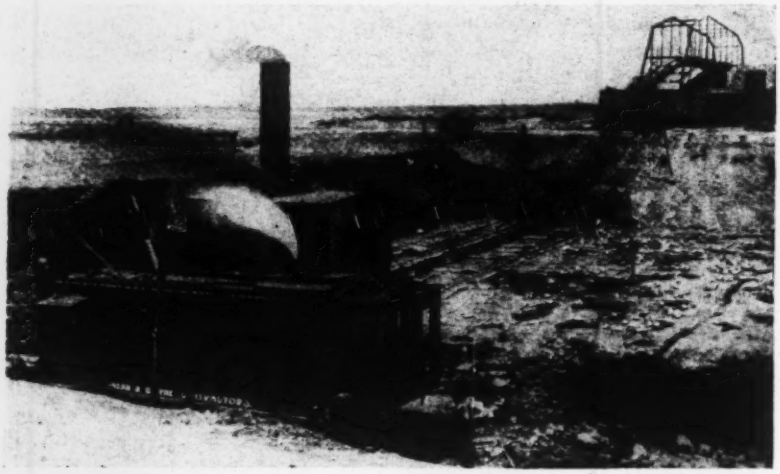


Fig. 1. Mechanization in train: A steam shovel loading into an earth pulverizer feeding to a belt conveyor carrying to a gantry discharge bridge spanning the waste area or spoil bank. All elements of the train are wheel or roller mounted for mobility. (Chicago Drainage Canal, 1895.)

Birth of a new idea

It is curious enough to merit mention that mechanization has had its times of greatest progress in two periods of peak construction and interrupting depression. It has reached its highest perfection in the last two decades—in the twenty years of greatest road-building, tunneling, flood-control work, bridge building, power development and factory expansion that the world has ever known. It had its birth in the peak construction and crippling depression period of 1885-1897 that bore such great import to engineering and architecture.

Those were the years that witnessed the origin and construction of the score of tall steel buildings that distinguished the skyline of Chicago

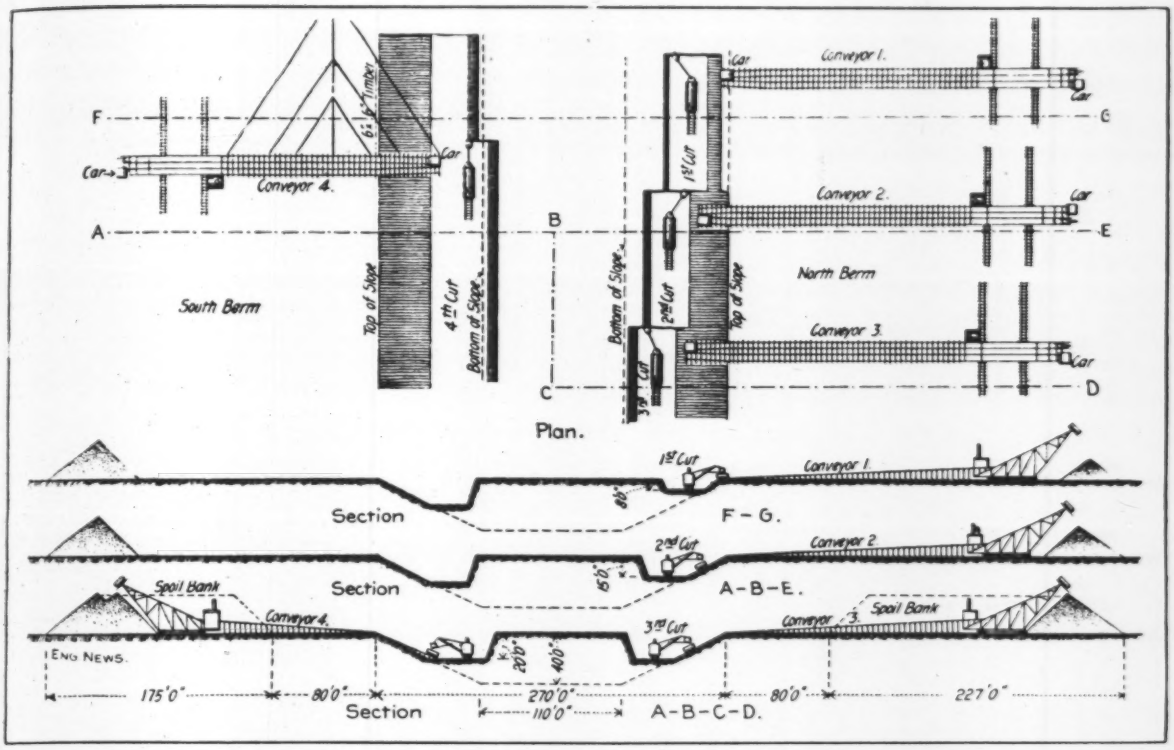


Fig. 2. Mechanization for division of labor: Groups of "mechanization in train" divide the work and speed completion. The unbalanced grouping is due to the greater waste area on one side. (Chicago Drainage Canal, 1895.)

alone until 1897. They were the years that brought the construction of 70,000 miles of railway and saw the approaching end of the excavation of 40,000,000 cu.yd. of earth and rock for the Chicago Drainage Canal. They were the years that included 1893, the year of the Columbian Exposition at Chicago that, as never before, carried the splendid possibilities of architectural art to millions of Americans. Together these works challenge comparison in creative values with those in any equal period of years in the last half century. Not the least of these values was the idea of mechanization of construction.

Railway construction led in advancing the idea, and the Drainage Canal operations established its practical application. Here construction, besides providing itself with machinery, began systematically to mechanize. The story is one that engineering writers generally have overlooked but that is too important to be forgotten. It was my opportunity fifty years ago to set down the facts in current print, and I believe that they warrant repeating now as a tribute to those earlier constructors who pioneered in modern equipment engineering.

The vital contribution of railway building to construction mechanization lay in synchronized steam-shovel excavation and train haulage in grading. By the early eighties most of the machines now used in construction, except those for processing and placing concrete, had been devised. Railway builders were quick to grasp their advantages. They soon found, however, that great capacity of tools to dig, hoist and carry alone did not guarantee commensurate production; that for this a proper combination of tools was more important than a great accession of tools.

Speed by coordination

The controlling operations in the fast railway building of the eighties were grading and tracklaying. Heavy tunneling and bridging were, wherever it was practicable, left for future accomplishment. Competition for new trade territories was keen; to get the line "through" quickly was the main objective. To attain it, improvements not immediately needed were bypassed to obtain speed in grading and tracklaying. Engineers and contractors searched out all means to increase speed. Improvement of construction equipment was one of them.

Grading equipment was the first problem. Immediate betterment of individual tools afforded scant promise; steam shovels, dump cars, track and locomotives were capable enough. Any promise that was to be seen appeared to be in better coordination of those four elements of a grading plant, and study was focussed on that. By the time the railway boom of the eighties had exploded into the bankruptcies and receiverships of the depression of 1893-1897 steam-shovel attack, track planning and train scheduling in railway grading had reached a perfection in timing that has never since been surpassed.

It is not pretended that order and plan in steam-shovel work had not previously existed in individual instances, but it was by railway engineers first that they were seen as a definite problem to be mathematically solved. A series of articles on "Steam Shovels and Steam-Shovel Work" by E. A. Hermann, published in *Engineering News* in 1893 analyzed this development. These articles, I think,

were the first calculated study of equipment engineering.

Considered mechanization began with systematized steam-shovel earth moving developed by the railway builders of 1885-1892. It was continued and advanced by the builders of the Chicago Drainage Canal, the next greatest earth and rock moving operation of the 1885-1895 decade. The canal work added number and variety to examples of mechanization and notable functional improvement of machines. It was, however, its showing of construction machinery in mass that attracted notice to those more constructive developments.

Equipment dwarfs structure

The Chicago Drainage Canal was the first large construction operation in America in which massed construction machinery occupied eye and mind to the subordination of the structure being produced. Nowhere before had so many different mechanical devices for excavating and moving earth and rock been in operation in so small an area. Few of the units of this great earth-moving plant were new. Steam shovels, cranes, dredges, derricks, cableways, compressors, drills, cars and locomotives, were all familiar tools of construction, but massed in tens, twenties and hundreds they shocked the observer into new realization of power-tool development for construction.

The canal construction plant was in striking measure a summation of tools of construction. All the tools were familiar, but they had not before been totaled visually. To many engineers the canal plant was a revelation that set them to thinking of power tools instead of masses of men as factors of construction. The fact is stressed because it begot a major contribution to construction machinery development. This was the inventive interest of engineers in improvement of construction tools.

While number and variety of tools was the first observation, longer inspection disclosed systems of grouping. It showed that on the canal there was more than a medley of machines digging, lifting and conveying earth and rock; that size, number and variety of purpose of the machines at work were not the vital facts. Instead it showed that digging, loading, lifting and carrying were intermeshing processes of a single operation; that the canal excavating plants were not some excavators, loaders, and carriers at work, but were trains of such devices conjoined and timed to work together. True, the timing and coordination often were unbalanced and incomplete, but a conscious attempt to accomplish both was everywhere evident and sometimes it was remarkably successful.

Space permits only a single example to be named; there were a score that were equally perfect. This example comes particularly to mind because it was an early installation, perhaps the first considerable installation for earth moving, of the belt conveyor. A steam shovel making an across-canal cut loaded into a mobile pulverizer that fed onto a belt conveyor that extended across the canal bottom, up the bank and a trestle incline onto a gantry that straddled the spoil bank. Conveyor, trestle incline and gantry were so mounted that they could be rolled along the canal as the steam shovel made successive cuts. It is repeated that this was only one of a score of excavator, loader and conveyor plants whose units were coordinated and timed to work in train.

The question naturally arises: Why should this general movement toward mechanization have appeared so suddenly on the Drainage Canal work? There were several reasons. The idea had been promulgated by the experience in steam-shovel railway grading. The construction operation, except for a few miles of dredging, was to excavate a regular prism and deposit the excavated material close by on the banks; this made possible short trains of machines, particularly conveyors. Then, more often than was common at the time, the canal contractors were engineers or they employed engineers. Finally the aid of machine builders was enlisted to produce functional improvements in standard tools to adapt them to new purposes.

Functional improvement

Functional improvements took a wide range in detail, but the two of fundamental importance were: mobility and automatic power-dumping. Both were necessitated by the canal work. The volume of excavation per lineal foot of canal was not large. The canal cut lengthened rapidly. But as it did, excavators, track, loaders and conveyors had to keep abreast by frequent advances.

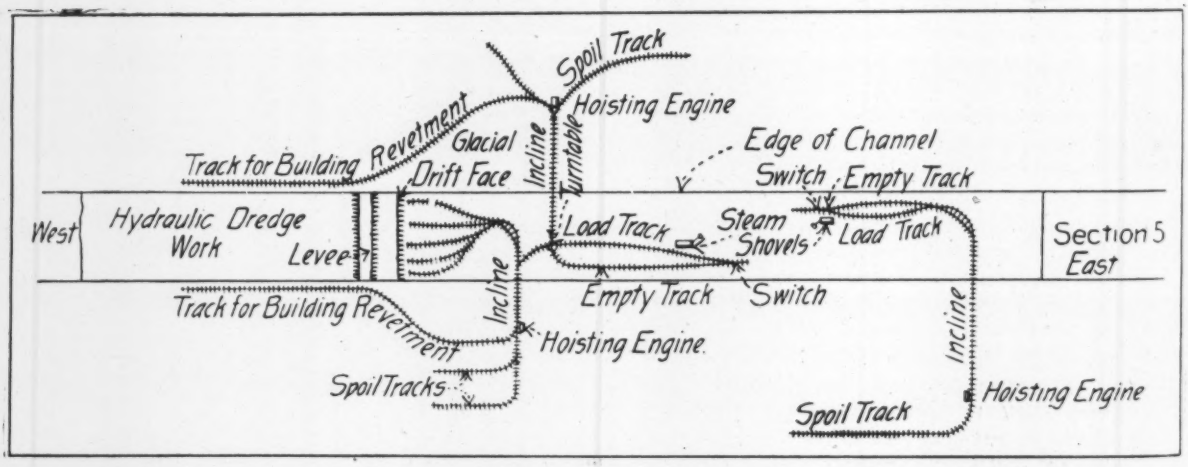


Fig. 3. Mechanization for variety of operations: Quarrying, wall building, rock excavation and earth excavation by plants adjusted in capacity to complete the operations at about the same time. (Chicago Drainage Canal, 1895.)

In a mile of canal many moves ahead were required. For many of the plant units used, this requirement had not previously been envisioned. Cableways, derricks, conveyor-trains, trestles, bridges and tipples had been considered as stationary plant, movement of which was a process of dismantling and reerection. Now, on the Drainage Canal, all of these structures had to be put on wheels. Nowhere before in America had construction plant units of such dimensions and weights been made mobile and some of them selfpropelling.

The task of fitting the equipment for the canal work for easy mobility did much to fix the minds of equipment engineers on the importance of mobility for all construction tools. At the time the most that was possible with car trucks and railway track was done. Present perfection had to await development of crawler traction.

Automatic discharge developed

But putting the canal construction plants on wheels, while more striking to the eye, was no more vital to mechanization than was automatic power-discharge of load. Cableways, derricks and cranes standard at the time, had been designed on the supposition that the load was to be lowered into place or at least dropped in a way to reduce fragmentation and impact. No such requirements prevailed on the canal work. Instead the load was waste material; so long as it fell within the spoil-bank area it made no difference how far the load fell, how hard it fell or how much it was smashed in the fall. Time and power expended in lowering and gentle unloading were waste. New mechanism was required for this quick discharge of derrick, cableway and crane loads. Jointly the canal engineers and equipment manufacturers produced aerial dumping devices.

In some cases invention went even further. Some ingenious contractors equipped derricks and cableways to dig, to operate a scraper bucket as well as to hoist and carry an excavated load. They were job-built and crude, but with mechanical improvement one became the modern "dragline" excavator and the other the "tower" or "cableway" excavator without which millions of yards of Mississippi valley levees and other millions of yards of earth moving would have been much slower accomplishments.

Need to increase speed in the competitive railway construction of the eighties led to a study in coordinating grading equipment. It was found that by planning steam-shovel attack, track system and the number, capacity and timing of work trains as a single mechanism, earth moving capacity was increased. This idea was taken up by the engineer-contractors for the Chicago Drainage Canal in 1894-1896 and extended to a greater number of earth- and rock-moving machine combinations.

Great earth-moving operations since the Chicago Drainage Canal have added nothing to the principle of mechanization established there and by the railway builders of the eighties. Contrarily, however, there has been enormous advance in the size, mechanical perfection and power of earth-moving machines and in the number of special-purpose machines introduced into the mechanized train for greater division of work. The evidence is worth noting.

Panama was great haul job

At the Panama Canal, the next large single work of American engineers, earth moving, except at Culebra cut, was a hydraulic fill or an underwater dredging operation, and at Culebra it was a straightforward steam-shovel and train-haulage operation. In a book-length description of the Panama work published in 1914, the writer, discussing Culebra said: "The problem was the same as that at any rock cut for a railway in the United States, but it was that problem magnified many times." In brief the task was to coordinate steam-shovel attack, service-track laying and train scheduling. With from 46 to 75 shovels working, from 170 to 210 miles of service track, 159 locomotives and 1,100 cars (3,500 to 5,000 loaded daily), train scheduling required a train dispatcher's office and staff but no change of operating principle. On the dump there were added car unloaders, spreader cars and track-shifting cars to divide the work of spoil disposal—that is, the units in the mechanized train were increased.

The building of the Miami Conservancy District dams in Ohio added to earth moving mechanization dragline car loading at borrow pits, train haulage to hog-box sumps, pumping from sump through pipeline to the dam fill—another combination of machine units operating in train. Incidentally this great earth-moving operation for flood protection in the Miami River valley was the first on which, in a large way, the dragline excavator replaced the steam or power shovel. Also it was the first in which electric-powered machines predominated.

Peak reached on levees

In the greatest earth-moving operation of all, the enlargement of the Mississippi River levees begun in 1928, mechanization as defined did not develop in an important way. There were, however, outstanding developments of single machines that combined excavation from borrow, transportation to levee and placing of levee fill in one operation, also the development of tractor-scraper units that performed all three tasks. Here the crude dragline and cableway excavator and the horse-drawn wheel scraper of the Chicago Drainage Canal were developed to a peak of size, power and capacity.

Mention has been confined to mechanization of earthmoving. The principle finds its most perfect practice today in concrete construction. These recollections, however, already exceed reasonable space and also were intended only to disclose origins in a great construction development. In the great earth-moving operations of the railway and Drainage Canal engineering contractors of the 1885-1895 decade all the essential processes for the present development of construction mechanization were set in motion.

This reminiscence of old days is born of reflections on the need for keeping the history of American construction developments complete and accurate. As a service to engineering construction, the vital contribution to progress made by the mechanization of construction operations ranks equal with the development of modern steels, of pneumatic foundation and tunneling methods, of the steel skeleton building, of reinforced concrete, of electric and internal-combustion engine power, and of prefabrication and other construction developments always held up for admiration as monuments of construction progress.

Classifying Ready-Mix Concrete Plants

L. D. Long
Newark Testing Laboratories
Newark 5, N. J.

***Editor's Note**—Radically new—and raising several questions of procedure—is this proposal for improving ready-mix concrete plants and their product. By rating them on the basis of uniformity of quality of output, the more efficient plants are given a cement-content advantage. Inspection is given high place in the rating system proposed.*

A MERIT RATING PLAN can be devised that provides an incentive for commercial plants to produce only uniformly good concrete. Based on uniformity of materials used, batching and mixing equipment installed, inspection, integrity of the plant personnel and past performance on a basis of test cylinder records—a classification of ready-mix concrete plants can be made that would permit producers to use only the amount of cement their particular plant requires to supply concrete of a specified strength consistently. A competitive plant might be required to use more cement, or be permitted to use less, as necessary to provide the same minimum strength.

At the 1944 convention of the National Ready-Mixed Concrete Association. Stanton Walker, engineering director of that organization, presented a paper, "Application of the Theory of Probability to the Design of Concrete for Strength Specifications", in which he showed how past performance records of a concrete plant can be used to determine the design mixture that is required for that plant to produce concrete of any minimum specified strength.

An important possibility of this theory is use by a buyer of concrete to fix separate and distinct strength requirements, that will be fair and just, for each concrete plant permitted to bid on his work.

Mr. Walker's application of the probability curve, which can be presumed to be mathematically accurate, bases prediction of future results on past performance as revealed by cylinder tests. In the ready-mix concrete field, however, such tests are seldom, if ever, available. Ready-mix plants do not make tests of all concrete produced and such tests as are made are usually on concrete that is produced to meet definite specifications. These tests, therefore, do not represent accurately the plant's whole performance.

Inspecting engineers, and testing laboratories, however, know from long experience about what to expect from each type of batching, mixing, and transporting equipment now in use. With this experience, it is possible for them to predict the results to be expected from any type of plant equipment and, conversely, to set up a schedule of plant and equipment by means of which any given concrete plant can be put into its proper place in the Walker classification.

Integrity is essential

It should be emphasized, however, that this proposed method is purely

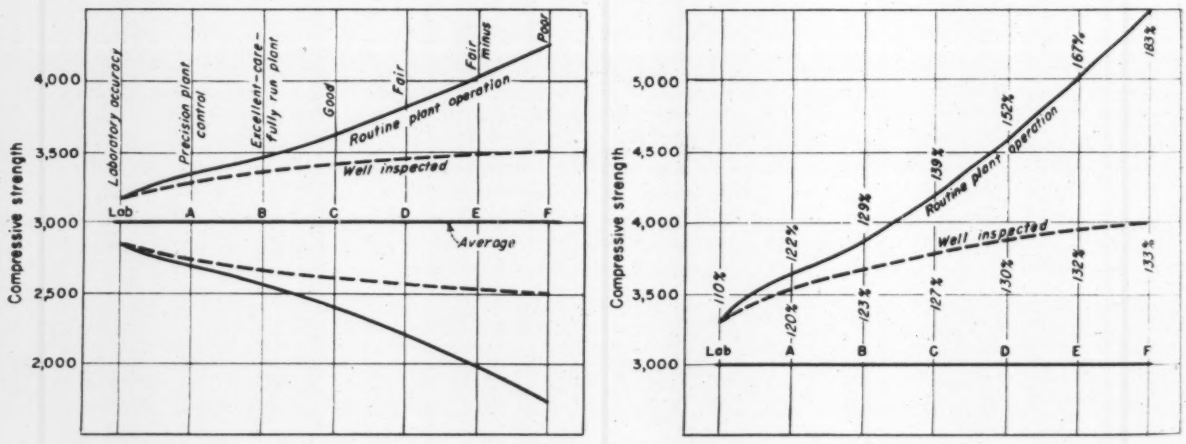


Fig. 1. Graphic illustration of cement advantage that should equitably be given a well equipped and well inspected concrete plant. Graph at left shows how test cylinders will vary for an average 3,000 psi. concrete. Graph at right shows that a first class plant will produce concrete with a minimum of 3,000 psi. by increasing the design strength 20 percent (about 15 percent additional cement) over the theoretical requirement while a poor plant may require 83 percent overdesign or 73 percent additional cement.

empirical, that it could produce abuses if not used honestly, that, like any other tool, it can be improved as experience is acquired in its use and, above all, that good equipment means little unless accompanied by the desire and intent to use it honestly and effectively.

Starting with the tables and charts from Mr. Walker's paper, the development of the proposed method is as follows:

The expected plus-or-minus strength variation of concrete, designed to produce a 28-day strength of 3,000 lb. in the concrete laboratory and in plants of Types A to F inclusive are shown in Fig. 1. The co-efficients of variation for these would be: Laboratory, 5 percent; Class A, 10 percent; B, 12½ percent; C, 15 percent; D, 17½ percent; E, 20 percent; and Class F, 25 percent. This chart shows two curves of plus-and-minus strength variation, one for routine plant operation and one for plants operating under good inspection. The latter was not included in Mr. Walker's analysis but was added by the author.

Similar data, arranged for the poorest cylinders to be above the minimum strength is shown at the right in Fig. 1. This chart provides an estimate of the value of inspection. For example, a Class-D plant with good inspection would produce concrete of about the same quality as a Class-B plant without inspection. It shows also that a Class-E plant, without inspection, would have to design for 5,000 lb. to produce 3,000 lb. concrete. This chart, taken directly from Mr. Walker's analysis, shows very effectively the value and necessity of good batching and control equipment.

Water-cement ratio governs

A typical chart that the buyer would use is shown in Fig. 2, but this would be replaced by a specific chart for any particular set of conditions. If the buyer has selected three plants and classified them as A, C and E then, for 3,000-lb. concrete—assuming the materials to be the same at all plants—the Class A plant would be permitted to use a maximum water-cement ratio of 6.5, the Class C plant 5.9 and the Class E plant 5.0 gallon per bag. Under strict inspection these figures would be 6.6, 6.3 and 6.15 respectively.

Table I—Valuation of Factors Affecting Uniformity of Concrete

	Percent
Gradation changes	10
Weights and measures	20
Water control	20
Mixers and mixing	15
Inspection and testing	35

So far, the development is based entirely on the Walker mathematical analysis. To co-ordinate this with conditions in actual concrete producing plants, empiricism, based on experience is the only possible method. This can provide a tentative standard that can be modified as experience in its use is accumulated.

Several factors affect concrete

The factors most commonly affecting the uniformity of concrete and the percentage values assigned to each according to its estimated relative influence in causing variation in the quality of the finished product are given in Table I.

Some of the background for these values is as follows:

A change of 0.4 in the fineness modulus of coarse aggregate, as for example from 6.8 to 7.2, will cause from 150 to 400 psi. difference in the strength of average concrete, depending on the cement factor and type of coarse aggregate, equivalent to 1 in. slump.

A change of one half gallon of water per bag of cement, or slightly less than one half bag of cement per cubic yard, will cause a change of from 300 to 500 psi. or 2 in. in the slump. Much greater changes than these are common in too many plants, although the water problem has received considerable attention. It is not so well known that changes in the moisture content of the aggregates will, unless compensated for, cause a variation in the cement content of as much as one eighth of a bag per cubic yard, as will also a discrepancy of 100 lb. or less per cubic yard in the weight of aggregates.

Poor mixing, mostly caused by in-

TABLE II. CONCRETE PLANT CLASSIFICATION SCHEDULE

		Score
Gradation Items	**[Maximum 10 points]**	
Cleanly separated stock piles or storage bins		1
Stock piling in layers to minimize segregation		2
Non-segregating method of loading hoppers		2
Aggregate size combinations available: 1. 100 to 8 or 4 [sand]; 2. 8 or 4 to ⅜ or ¾ [pea gravel or fine stone]; 3. ⅜ or ¾ to 1 or 1½; 4. 1 or 1½ to 2 or 2½ [one value only]		
1–2, 1–2–3 or 1–2–3–4		5
1–3 or 1–3–4		3
1–4		1
Weighing Items	**[Maximum 20 points]**	
Separate scales for aggregates and cement		5
Dial scales of ¼% tolerance	Cement	5
	Aggregates	3
Dial scales of ½% tolerance	Cement	3
	Aggregates	1
Automatic cut-off	All material	7
	Cement only	3
	Water only	2
	Cement & Water	5
Water Items	**[Maximum 20 points]**	
Added water under the complete control of the plant inspector or the job inspector or both		10
Compensation for moisture in the aggregates		
Aggregates and water		10
Water only		6
Consistency meters or plant-mix with split loading		6
Deduction for uncontrolled wash water		10
Mixing Items	**[Maximum 15 points]**	
Condition of mixer or mixers, maximum		5
Time lock or other control of mixing time or revolutions		5
Difference in slump between the first 20% and the last 20% of each batch, less than one inch		5
Inspection and Testing Items	**[Maximum 35 points]**	
Room or space reserved for testing on the mixing platform and in full view of all operations		5
Aggregate testing equipment		5
Moisture testing equipment $\left(\frac{15}{\text{Minutes required for test}}\right)$	not to exceed	15
Proof of performance, automatic records or automatic weight tickets		10

efficient mixers or mixers with worn blades, is believed to cause a greater variation in quality than would normal changes in gradation, but less than normal changes in cement and water content.

In the percentage table, the field of inspection has been given a greater value than any of the other items because it can decrease the variations that would otherwise take place by at least one third. Inspection and testing is meant to include not only inspection agencies but also self inspection by the manufacturer and all mechanical apparatus that can provide information used to control variables as well as automatic records of performance.

The suggested schedule for scoring concrete plants is given in Table II.

An additional number of points, not to exceed 15, may be added to the score of any plant whose service record would justify a higher rating than the mechanical point scoring would indicate, or plants may be classified by cylinder-test records when these are available. This additional number of points should be based solely on the ability and service record of the manufacturer's plant and the equipment used. Full point credit should be given for methods or equipment that are different from these listed but that will insure equal uniformity in the finished product.

Classification on merit basis

Based on the total score, plants can be classified as shown in Table III. This schedule is made on the assumption that it is the intent of the plant to use its equipment honestly and to the maximum of its effectiveness. Plants that do not show such intent should be rated one, two, or more classes below the class indicated by the score, depending on the plant's reputation in that respect.

In designing concrete mixes, each plant will be required to use the applicable curve on a chart similar to that shown in Fig. 2 but based on the materials used by the plant.

In the preparation of the classification schedule, the selection of items and the values assigned to each are purely arbitrary but represent the consensus of several engineers, testing laboratories and contractors who have been consulted. Users of this method can of course change the items and assign values to fit their own ideas without impairing the value of the methods.

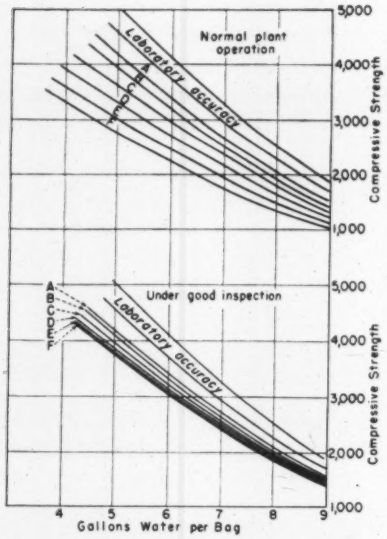


Fig. 2. Maximum gallons of water per bag of cement to produce the minimum compressive strength shown.

Plant classification is obviously a prerogative of the buyer, who has the right to name his own conditions of purchase. Consulting engineers, architects or contractors dealing in large construction projects could do their own classifying, as could the engineer or architect of any particular project. Perhaps all plants in an area could be classified by a "disinterested" committee selected by joint action of users and producers of concrete in a locality. But classifying should be done fairly, by a trained engineer or an experienced testing organization, as grave damage could be done to a concrete producer by improper classification. Provision should be made for reclassifying, either up or down, whenever changes in conditions warrant.

Reference to Fig. 1 (left) will show the fairness of this method. Assuming that the chart is approximately correct, and it can be corrected if experience should show that it is not, the *unfairness* of forcing plants in classes A and E to compete on even terms, for a job on which the quantities of all ingredients are specified, becomes immediately apparent. The Class A plant will deliver concrete 95 to 100 percent of which will test above 2,650 psi. while the Class E plant will deliver a product 95 to 100 percent of which will exceed only 1,980 psi. assuming that the same materials are used in both plants.

The buyer, in all fairness, is entitled to demand that the Class E plant use sufficient cement to make its most inferior product equal to the most inferior product of the Class A plant.

TABLE III—PERCENTAGE OVER DESIGN MINIMUM STRENGTH REQUIRED FROM CLASSES OF CONCRETE PLANTS

Score	Class	Percentage
More than 90	A	5 –10
Between 75 and 90	B	10 –12½
Between 55 and 75	C	12½–15
Between 35 and 55	D	15 –17
Between 15 and 35	E	17½–20
Less than 15	F	20 –25

New Services Banned For St. Paul Suburbs

In an effort to bolster lagging development of property within the city limits, St. Paul, Minn., has readjusted its contracts and agreements with suburban areas outside the corporate limits for sewer connections, water connections and fire protection. Under the new arrangements no further sewer connections will be made except where previous contracts obligate the city, and where adjustments will be made in fees; new water connections will be made only within the perimeter of the area now served. In addition, fire protection will be withdrawn on the first of next July.

Suburbs pay less than cost

A recent analysis of the outlying sewer connections indicated an annual cost of $12 per family whereas the city has been collecting only $6 per family for this service. Any extensions hereafter must be made on an area basis and will require annexation—and one of the requirements for annexation will be adequacy of existing sewer facilities.

Water service in suburban areas outside the city costs slightly more than inside. A charge for fire hydrants is also made. But although city water users may be benefited by profits from suburban areas this is offset by the premium placed on outside land in competition with inside property. No further water extensions will be made, therefore, except in areas now served.

Kiln Furnace for Rubbish Incineration

***Contents in Brief**—An incinerator designed to burn combustible rubbish, now under construction in Los Angeles, includes the following features: Four self-stoking rotary kiln-type furnaces; a shredder to reduce material to 1½-in. maximum size before burning; and a water spray to cleanse the products of combustion before they are discharged to free air. The plant, with a capacity of some 20 tons per hour, is expected to require only 6 operators as compared with 30 that were needed in a former plant abandoned in 1943.*

AN INCINERATOR containing four rotary furnaces is the means by which the city of Los Angeles hopes to solve a rubbish disposal problem which has existed in that city for several years. Each of the furnaces will have a capacity of 5 tons per hour, and will be fed automatically with rubbish shredded to 1½-in. maximum size. It is claimed that the entire operation will require only 6 men as compared with 30 needed in a previous plant that was abandoned in 1943. The incinerator is to be financed by a plan whereby the city agrees to lease the new unit from the contractor building it for 9 years and 9 months with yearly options for outright purchase by the city.

Cost to the city according to the terms of the contract under which the new unit is being built is $7,479.97 per month for the 9-year-9-month period. This monthly charge is for the plant only and does not include the cost of operation and maintenance. Such a plan is expected to provide the city with a satisfactory means of disposal without any large initial expenditure for plant such as would require a bond issue, and yet keep the operation strictly in the hands and under the control of the city.

A recapture clause in the contract gives the city opportunity to purchase the plant at yearly intervals during the 9-year-9-month period at stipulated prices, which decrease constantly as time goes on. At the end of the contract period (during which time the city is to have paid the monthly rate agreed upon) the plant becomes the property of the city upon a final payment of $32,605.

Background of the situation leading to this arrangement is:

For many years Los Angeles has segregated refuse into three general classifications: (1) Food waste, (2) rubbish, and (3) non combustible waste.

Residences, restaurants, clubs, etc., have two containers, one strictly limited to "garbage" (defined by ordinance as nothing but food waste free from paper of other foreign matter), which goes by gondola car to a hog farm (*ENR* Oct. 3, 1946, vol. p. 451), and one for non-combustible refuse, which is also collected by the city and is separately handled by a disposal contractor and sorted for salvage of metal, bottles, etc. Non-combustible plant operation was described in *ENR* March 3, 1927, vol. p. 526. Combustible rubbish is collected by private licensed collectors who charge a fee proportionate to the service rendered. It is this rubbish which will be burned at the new incinerator.

Several plants are planned

When the new plant is placed in operation, it is expected that the daily load will be some 300 tons of combustible rubbish. City officials expect that full capacity utilization (480 tons per day) may be reached within a year thereafter. Their plan is to build a series of similar units to serve only the central part of the city.

The new incinerator (first of the series) takes the place of a former unit, built some 20 years ago, which has been closed since December 1943 due to partial collapse of the furnaces. Reconstruction of this old incinerator was not possible during the war and is considered imprudent at this time because of its obsolete type and high operating costs. Furthermore, it was a serious fire hazard to nearby oil refineries because of the discharge of glowing embers from the stacks, a condition which has been corrected in the new plant.

After closing the old incinerator, rubbish was disposed of at dumps both inside and outside the city. Recently, however, many of these dumps have been closed by court order or cancellation of permits by governmental agencies, primarily due to public pressure to abate the smoke nuisance.

Process tested in 1937

The design of the plant makes use of the "Duerr Process" (based on patents held by H. O. Duerr) which was tested by the city by the operation of a pilot plant in October 1937. The time lapse between successful pilot plant operation and the letting of the contract for construction was caused (1) by the necessity of getting favorable decision from the state Supreme Court on the validity of the methods used whereby the plant is leased from the contractor over the 9-year-and-9-month period and (2) by the war.

The pilot plant consisted chiefly of a kiln about 30 ft. long and 48 in. in diameter. Tests were carried on to determine the best angle of inclination and the optimum rate of turning. Much additional information was also gathered concerning various phases of the incineration process.

The success of the experimental unit was such that city officials were able to proceed with confidence in the preparation of general specifications for a larger plant. This new plant consists of four rotary furnaces, each of 5-ton-per-hour capacity, with additional process equipment to permit the operation of each furnace as a separate unit, providing flexibility of operation and making it possible to take one or more furnaces out of service for repairs without a complete plant shutdown.

Rubbish is brought to the plant on

trucks and is dumped into a 300-ton capacity storage pit. The unloading platform at the pit has provisions for sixteen trucks at one time. Four electric motors operate winches for fourteen sets of "pull-off" block and falls for unloading non-dumping trucks into the pit, permitting an estimated average dumping time of 3 minutes per truck. Single pieces of rubbish larger than 4x4x1 ft. are to be cut by a suitable power saw before being dumped into the pit.

Two traveling clamshell cranes, 2 cu.yd. capacity each, are provided to move the rubbish from the storage pit and drop it into either one of two hoppers, each of which serves one shredder. The crane operators will be able to blend the rubbish to a certain extent to reduce extremes in the moisture content of a furnace charge. For example, crane loads of paper waste from downtown office buildings may be alternated with wet garden clippings. Such a reduction in the extremes of moisture content will permit more uniform combustion and thus contribute to better operation of the plant.

Shredders aid combustion

Rubbish is fed from the hoppers to the shredders by two hydraulic rams, one for each shredder. Each ram has an 8-ft. stroke and it feeds into an opening some 20 in. high and 5 ft. wide.

Each of the two shredders has a capacity of 15 tons per hour and is driven by a 150-hp. motor through a hydraulic coupling. These shredders, which are of the hammer-mill type, shred the rubbish to the size of a walnut by the action of 36 blades mounted on four shafts and rotated around a central axis at a speed of 1,200 rpm.

Car fenders are "chewed"

Rubbish is pushed into the shredder over a hardened steel surface or "anvil." The blades as they rotate clear the anvil by only a fraction of an inch so that they literally chew the rubbish to small pieces. The blades are free to rotate on the four shafts which are some 2 ft. from the axis of rotation of the shredder so that, when an object which is too hard to shred is pushed into the machine, the blades fly back and the rotation continues. In such an instance, to clear the machines, they must be shut down and the hard object removed.

The shredders are said to be capable of handling such material as car fenders, snarled steel wire, and even automobile axles; however, hardened steel objects like differential gears are too hard for the machine to break. Material of this kind is found only occasionally in the rubbish, but to determine the capacity of this type of machine, such material was used in the test.

Shredded rubbish is carried by a continuous drag-type conveyor to chutes leading to hydraulic rams that feed each furnace. Surplus rubbish is carried to an overflow storage bin of 25 tons capacity from which withdrawals can be reconveyed to the overhead chutes as needed. Hydraulic rams which feed the rotary furnaces are in the form of a half circle of 30-in. diameter and 18 in. high. They are variable speed and average some six strokes a minute.

Slowly revolving furnaces

Each furnace is lined with 9 in. of refractory bricks and has the shape of a frustum of a cone 32 ft. long, with net inside diameters of 11 ft. at the inlet end and 7 ft. at the outlet end. The axis of the furnace has a 15 percent slope and the furnace has a range in speed of from one revolution every five minutes to one revolution every 14 minutes. Average time of retention in the furnace is 1 hour 15 minutes.

Rubbish is fed into the upper end of each furnace where it is preheated.

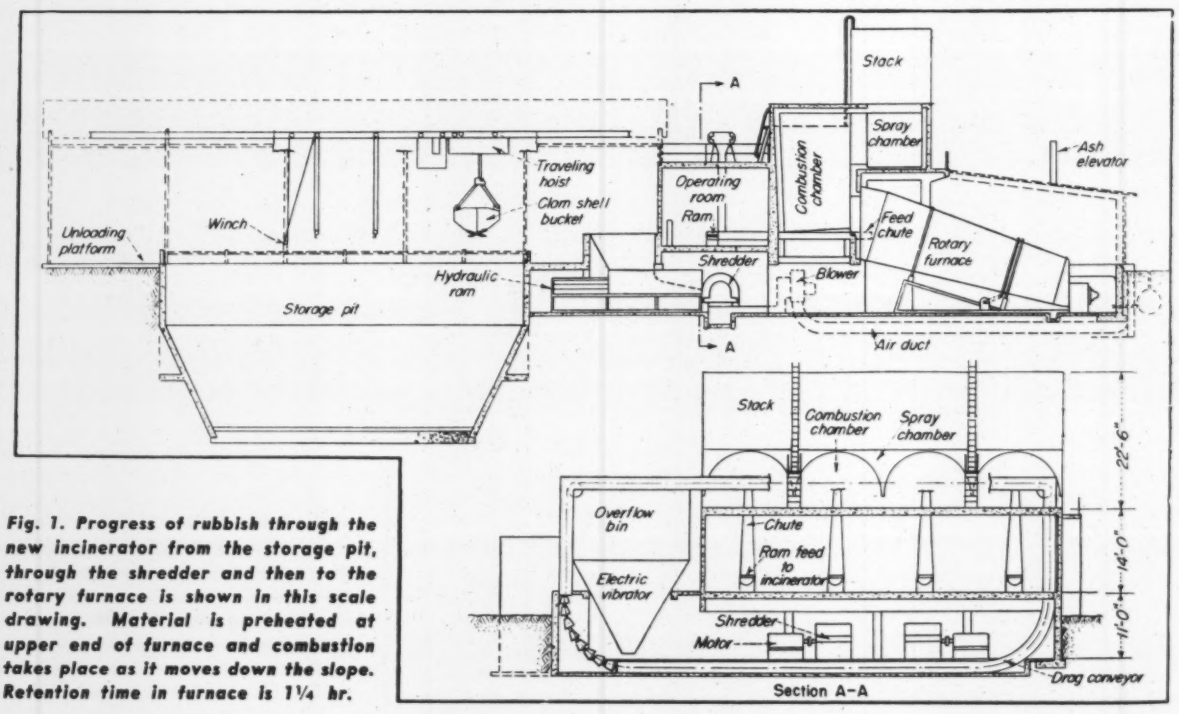


Fig. 1. Progress of rubbish through the new incinerator from the storage pit, through the shredder and then to the rotary furnace is shown in this scale drawing. Material is preheated at upper end of furnace and combustion takes place as it moves down the slope. Retention time in furnace is 1¼ hr.

As the material moves down the slope of the furnace, combustion takes place and the residue, an inert mixture of granular ashes free from clinker, is dropped from the lower end of the kilns into a quenching trough. From this point it is moved by a drag conveyor to a collection pit. Waste water from the spray chambers is used in the quenching process.

Combustion is aided by forced draft with air at room temperature at a rate of 12,500 cfm. for each furnace. Part of the air thus fed into the furnace is exhausted from the shredders carrying with it dust and fine paper. One 25,000-cfm. capacity blower serves each pair of furnaces. Oil is used as an auxiliary fuel when needed to bring a cold furnace up to operating temperature or for burning rubbish with a high moisture content.

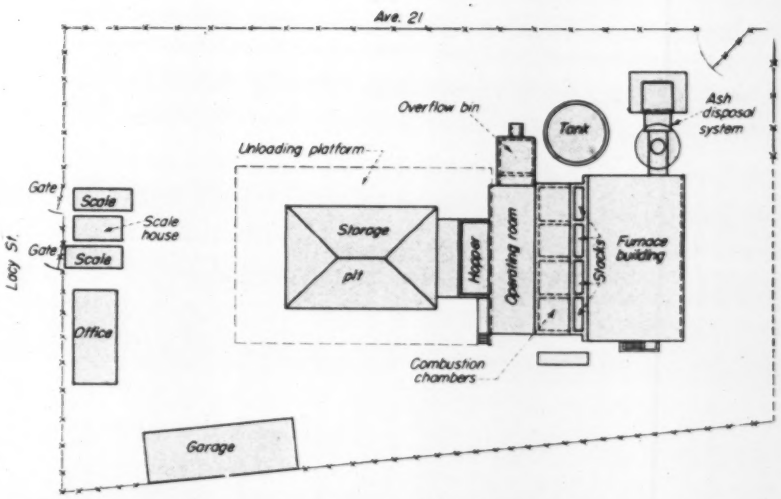


Fig. 2. Major structures required are shown in this plot plan of the incinerator area. Rubbish-filled trucks enter from the right (Lacy St. side). Ashes can be removed by truck through the gate shown at the upper right.

Gases cleansed by sprays

Gases from the rotary furnaces pass into combustion chambers located at and above the inlet end of the furnace. The products of combustion then pass into and through a spray chamber before entering a short stack. In each of the four spray chambers, there are seven nozzles operating at 30-lb. pressure and using 100 gpm. These spray chambers, in addition to cooling the gases resulting from combustion, remove fly ash and other objectionable matter.

Anticipated operating temperatures in the various parts of the combustion unit are as follows: Furnace 1,400 deg. F., combustion chamber 1,600 deg. F., stack 600 deg. F. The combustion chamber is built to withstand a temperature of 2,000 deg. F.

Stacks extend to a point some 40 ft. above ground surface. This relatively low height is said to be practicable because of: (1) thorough cleansing of the products of combustion prior to discharge; and (2) the forced draft.

Operation requires few men

City officials hope to be able to operate the unit with the following personnel on each shift: One operator and maintenance man, two crane men, one furnace man, and one utility man. A plant superintendent will be required to supervise all incinerator operations. This represents a considerable saving in manpower over that used in the previous Los Angeles incinerator, and is believed to be less than required by many municipal incinerators of similar capacity.

When the plant is completed, a final acceptance test 30 to 60 days long will be made. During this period, the plant will be operated under varying operating conditions to satisfy city officials that it conforms fully to the specifications and the contractor's proposal. All of the city's combustible rubbish will be taken to the unit so that the test will be a complete "on stream" test. All of the expenses involved will be borne by the contractor who will receive payment of 75 cents per ton for rubbish burned.

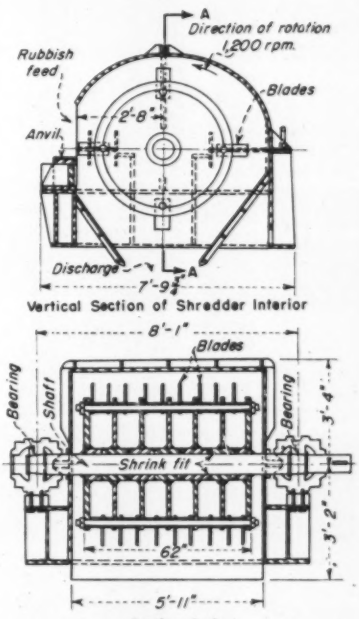


Fig. 3. One of the key features of the new rubbish incinerator is the use of shredders containing blades revolving at 1,200 rpm. that literally "chew" the rubbish to a maximum size of 1½ in.

Detailed design and construction of the plant is being done, under a contract whereby the city makes monthly payments (as mentioned in the foregoing), by Griffith Co. of Los Angeles, for which E. B. Milnor is engineer for the design of the plant.

A contract for operating the plant after construction was let to H. O. Duerr, originator of the process, for $2,852 per month for tonnages up to 4,000 tons a month with a sliding scale ranging from 72.7 cents per ton to 66.7 cents per ton for tonnages greater than 4,000 tons per month and up to 10,000 tons per month.

Since the contract was let, Griffith Co. has purchased all patent rights in the process from Mr. Duerr, who remains associated with the firm in a consultant capacity.

Shredders are being manufactured by the Pearne and Lacey Machine Company, Inc., Los Angeles.

Waste disposal for Los Angeles is under the direction of H. P. Cortelyou, engineer-director of the Bureau of Maintenance and Sanitation.

Repairing an Old Phoenix-Section Bridge To Carry Modern Loads Safely

C. A. Johnson
Chief Engineer, Brown Company
Berlin, N. H.

Elwyn E. Seelye
Consulting Engineer
New York City

***Contents in Brief**—In this, the second of a group of articles developed by Mr. Seelye to emphasize the technical and economic importance of repair methods on structures, the problem of a weak and old truss bridge is considered. Joints were reinforced by incasing some in concrete, by supplementing others with welded gusset plates and thirdly by inserting rectangular pin blocks. End post Phoenix sections were incased in steel pipe, and truss members were reinforced by additional plates. The cost was $30,000 compared to an estimated $100,000 for a new bridge. The first article (ENR June 27, 1946, vol. p. 998) was entitled "Practical Repair Methods for Disintegrated Concrete Tunnel Lining."*

A PREMIUM was placed on the reconditioning of the Cascade Bridge across the Androscoggin River at Berlin, N. H., in preference to building a new structure since expenditures on the reconditioning could be charged as maintenance, whereas expenditures on a new structure would be considered capital betterment, all of which had a bearing on net income after taxes. Moreover, shortage of labor and the great difficulty of obtaining materials at any price further influenced the decision in favor of repair.

That the Cascade Bridge, two 135-ft. pin-connected wrought iron Phoenix truss spans (Fig. 3) represents a very extreme case of reconditioning is obvious from its history. Reported to have been erected in 1873, it served for thirty years on the main line of the Boston-Maine Railroad before being dismantled and rebuilt in 1903 on the Androscoggin crossing at Berlin for the industrial branch line of the Brown Company. There, locomotives up to 85-ton capacity plus 95-ton coal cars have operated over it for more than forty years.

By the time the reconditioning operations were started, serious corrosion had occurred in the ends of several floorbeams and in the top sway bracing struts. In addition, eyebar and pin deformation were indicated. The passage of a train caused large vertical deflection and a marked side sway, which, taken into account with computed overstresses and poor alignment of members, indicated a dangerous condition.

Under the assumed loading of an 85-ton locomotive and 95-ton coal cars, serious overstresses, near or beyond the elastic limit, occurred in the lower chord, upper chord, end posts, and first and second diagonals when the stresses were computed on the assumption that the members were in true alignment. Actually, the top and bottom chords were out

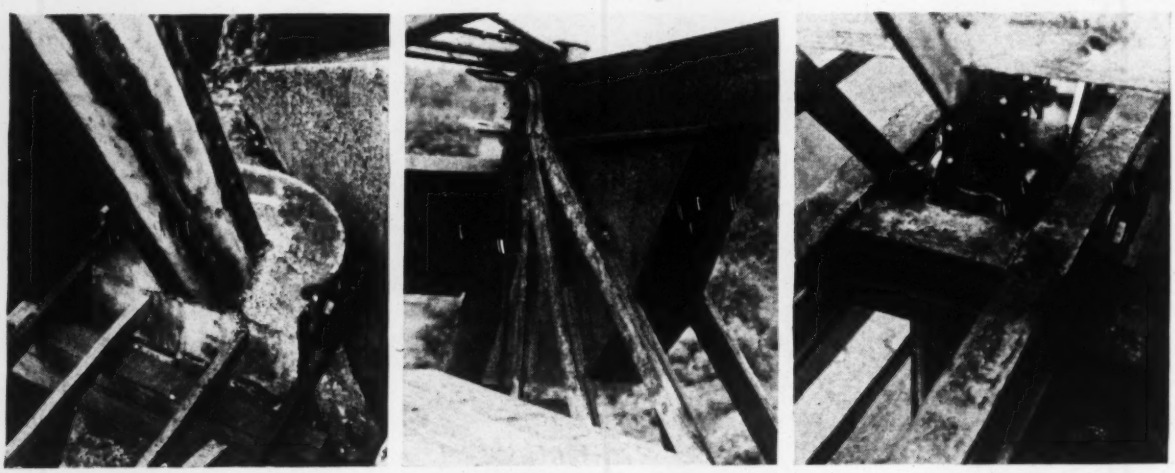


Fig. 1. Three methods of reinforcing pin joints. Left: End pin of lower chord incased in concrete. Note new, extra, bottom chord bar looped around concrete. Center: Hip joint pin supplemented by gusset plate to which diagonals are welded. Right: Cross plates welded to snubber block (not shown) which butts against pin to take horizontal component of truss diagonal.

of line at certain panel points as much as 2 in., producing an uneven bearing on the milled end surfaces of the main top chord longitudinal members. These surfaces had crushed, which in turn caused further deflection and higher stress on the surfaces already in incipient failure.

All of this damage had to be repaired and, in addition, clearance requirements necessitated the raising of the portal; since the portal was already much too flexible, more headroom could be achieved only by concurrent reinforcement of the portal members.

The feasibility of reinforcing this loose, rattling structure composed of ancient, worn members, largely too light and too flexible, was seriously questioned, and it required a careful survey and study of conditions, together with considerable original design, to determine that the bridge could be repaired and strengthened satisfactorily.

Reinforcement details

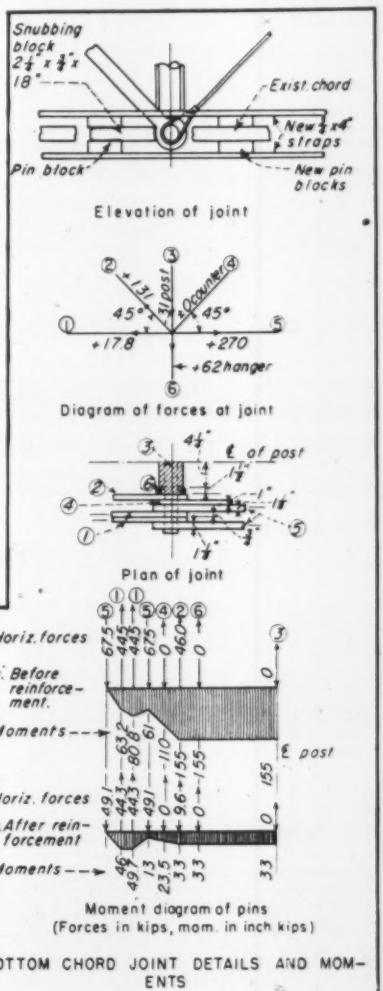
The reinforcement of the pins was handled in three different ways. For the lower chord end pin (Fig. 1, left) this was accomplished by concreting in the bottom of the end post, the concrete being placed inside a circular steel form around which were passed, in hair-pin shape, new bottom chord reinforcing straps. By this latter arrangement the additional stress from the lower chord reinforcement was transferred directly to the end post without affecting the end post pin, which then carried only the residual stress in the original lower chord bars.

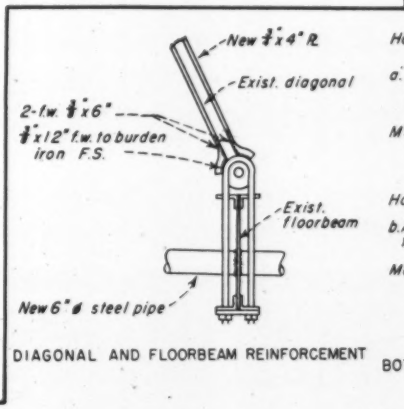
At the top chord hip joint, the pin was supplemented by the introduction of gusset plates to which the diagonal web member eyebars of the truss were welded. (Fig. 1, center).

The third, and perhaps the most interesting method of reinforcing the pins was used at the bottom chord joints. This was based on the elimination from the pin itself of the horizontal component of the truss diagonal by means of plates and snubbing blocks that carried the stress directly to the bottom chord as shown in Fig. 1, right and Fig. 2. The effect of the elimination of the horizontal component is shown in the moment diagrams in Fig. 2 of the pin before and after reinforcement.

The lower chord reinforcement deserves particular mention. Note that the snubbing blocks, shown in the elevation of the lower chord, Fig. 2, were introduced to carry the horizontal component of the diagonals from the eye of the diagonal to the pin blocks, so-called because they serve as supplementary pins. It is also to be noted in the plan of the bottom chord, Fig. 2, that the chord reinforcement consists of hairpins with the bars on edge up to the second panel point, and from there on bars laid flat, this change from edge to flat being made in the interest of compactness and facility of welding.

The sequence of welding of the old and new bars to the pin blocks was such as to permit prestressing of the new lower chord bar system without relative increase in the stress in the existing bars. For instance, since it was computed that the final average dead load stress in the lower chords would be 3,000 psi., wedges were driven between the hairpin bear-




New ½" x 4" R.
Exist. diagonal
2-f.w. ½" x 6"
½" x 12" f.w. to burden iron F.S.
Exist. floorbeam
New 6" ø steel pipe
DIAGONAL AND FLOORBEAM REINFORCEMENT

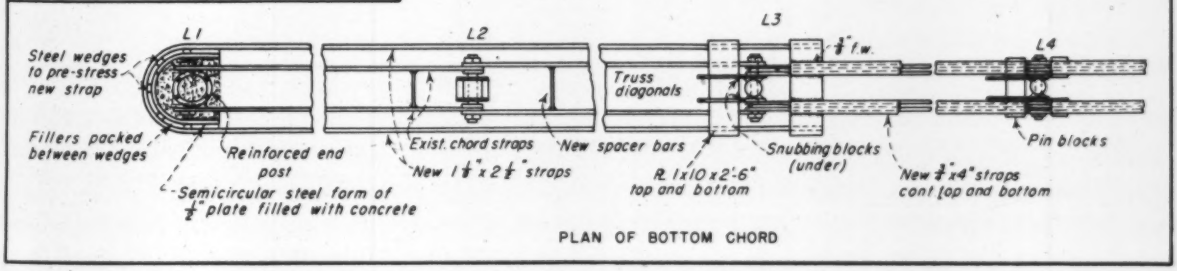


Fig. 2. Bottom chord reinforcing involved the addition of steel bars set vertically in first two panels and welded to top and bottom of existing chords elsewhere. Also the use of snubbing blocks at the panel points to take horizontal component of stress in the diagonals directly into the chord, greatly reducing the moment in the pins. Pipe struts between the floorbeams supply increased resistance to lateral truss deflection.

ing and the steel collar at the end post until the lengthening of the system indicated that this stress had been induced. After this, the welding of the pin blocks to the existing system was completed.

The end panel diagonals were strengthened as previously noted and shown in Fig. 1 (center) by welding them to the new hip joint gussets and by the addition of $\frac{3}{4}$ x 4-in. reinforcing plates. A detail in Fig. 2 shows how this eyebar reinforcement was welded directly to the floorbeam burden irons, which tended to relieve the bending in the pin.

In this same detail of Fig. 2, the horizontal pipe shown welded to both sides of the floorbeam was used to provide a stiff system of horizontal sway bracing for the bottom chord, the old structure having depended solely on its eyebars, acting as tension or compression members, to furnish horizontal truss action against lateral wind. This bottom chord had not only to resist horizontal wind thrust, but also had to be stiff enough to make the roller bearings act under expansion. Theoretically, the lower chord eyebars, being always under stresses with an algebraic sign of tension, could act as compression struts, but it was felt that their flexibility would permit a considerable lateral deflection when the bars of the bridge on one side were stressed by lateral wind loads up to, say, 24,000 psi. in tension and on the other side up to only 5,000 psi.

Fig. 4. Side plates welded to the Phoenix section top chord increase its area and resistance substantially.

tension. The rigid pipe struts were provided to reduce this lateral deflection in the lower chord system.

Strengthening of the end posts for the new elevated portal consisted of inclosing the original Phoenix column end post in steel pipe, and as a final reinforcing measure, 10x$\frac{5}{8}$-in. side plates were added to the Phoenix section top chords, Fig. 4.

Personal equation

Successful achievement of this type of job depends on careful teamwork between the designing engineer and the field. This job was carried out by company forces supervised by a capable construction manager furnished by the engineers. The company furnished experienced welders and a welding foreman. The importance of the welding may be realized from the fact that $3\frac{1}{2}$ tons of electrodes were used. A vital item in this construction was the furnishing of these men with adequate scaffolding, as cost and speed of construction are largely affected by the safety and convenience of the welder. The welding machines used were 400 amp. DC capacity and of straight polarity while the electrodes were E6012 type, $\frac{5}{32}$ and $\frac{3}{16}$ in. diameter.

The problem which presented itself was worked out so that the bridge was reinforced at a cost of approximately $15,000 per span, or $30,000, whereas the cost of a new bridge was estimated to run more than $100,000, assuming that the materials could have been procured.

Under test, the bridge proved free from objectionable vibrations. The vertical deflection was about $\frac{5}{8}$ in., and the lateral vibration at the top about $\frac{1}{8}$ in. Considering the material worked with, the results were considered eminently satisfactory both from the physical and the financial angle.

Elwyn E. Seelye & Co., the consulting engineers on the job, were represented by Burnside R. Value. The field work was in charge of Patrick Murphy acting as construction manager for the Seelye Company.

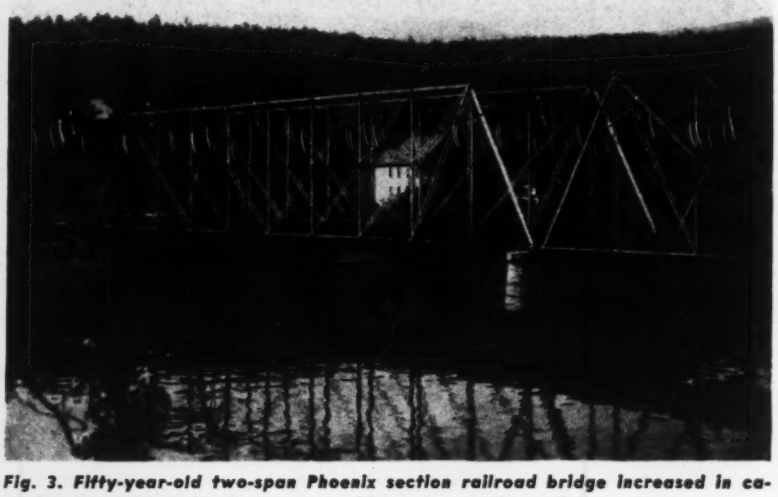


Fig. 3. Fifty-year-old two-span Phoenix section railroad bridge increased in capacity by welded details to carry 85-ton locomotive safely.

Engineer Examinations in New York State

The number of candidates taking the examinations for registration as Professional Engineers in New York State has been growing considerably. The totals for each of the last four years are as follows:

1943	1944	1945	1946
292	346	489	796

One of the examination papers that has proved exceptionally difficult for many candidates in the past is Part 2—Basic Engineering Sciences. In the last examination (June 1946) only 18 percent of the candidates failed in Part 2, whereas 30 to 40 percent of the candidates have been failing to pass this part in prior examinations.

Atlantic City Boardwalk Rebuilt With Precast Concrete Piles and Joists

***Contents in Brief**—To replace a 2,800-ft. section of the Atlantic City boardwalk destroyed by the 1944 hurricane, a concrete substructure was adopted for durability. Precast 16-in. octagonal piles, 32 ft. long, set 10 ft. apart transversely; cast-in-place combination pile caps and girders, 14 in. wide, 30 in. deep and about 20 ft. long; and precast joists, 5x13 in., spanning 18 ft. between bents, were used to simplify construction.*

WITH DURABILITY as the chief aim, a concrete substructure was selected for the replacement of a 2,800-ft. section of boardwalk at Atlantic City, N. J.; and for simple economical construction, precast piles and joists were used with cast-in-place combination pile caps and girders. Falsework was eliminated by supporting the girder forms on the piles.

Ripped out by the 1944 hurricane, this section is located near the mouth of Absecon Inlet at the north end of the 7-mile boardwalk. Because of the exposed location, city authorities decided that a concrete substructure with a timber deck would be best suited to withstand the onslaught of the northeasters.

Of precast concrete reinforced with eight ¾-in. bars and No. 7 spiral wire, the piles have a 16-in. octagonal section and are 32 ft. long with 2-ft. long tapered points. Two piles spaced 10 ft. apart are used in each bent in this section of the boardwalk, which is only 20 ft. wide in contrast to the 40 and 60 ft. used in front of the large hotels (Fig. 1). The bents are spaced 18 ft. apart.

Old piles used in construction

The contract for the new construction included a provision calling for prior removal of what remained of the old wood bents and the former boardwalk construction. However, the contractor elected to use the old wood piles as a support for a working platform, leaving their removal to the end of the job.

After the piles were in place, forms for the girder caps were hung from their tops by means of screw-type tie-rods. The cast-in-place girders are 14 x 30-in. in section, tapering to 14 x 23 in. at the ends. While they are 19 ft. 11 in. long for most bents, a 12-in. extension is built into the ocean side of every seventh cap to carry a light standard. Four hooked bars from each pile extend into the girder, anchoring it against uplift forces that may be exerted by the storm waves.

The sides of the girder forms were slotted to admit the 5 x 13-in. precast concrete stringers, which were set in position by a crane prior to placing of the concrete. Horizontal dowel anchor bars were inserted in holes cast for this purpose at each end of the stringers and then truck-mixed concrete, hoisted in buckets by a crane, was placed in the girder forms.

Two galvanized bolts were cast into the top of each stringer to fasten a wood nailing strip for the boardwalk deck. The stringers are 17 ft. 10 in. long, with a 2-in. space between ends of abutting stringers. At the expansion joints, located at every fifth bent, the ends of the stringers are wrapped in building paper to break the bond. The horizontal dowels are omitted

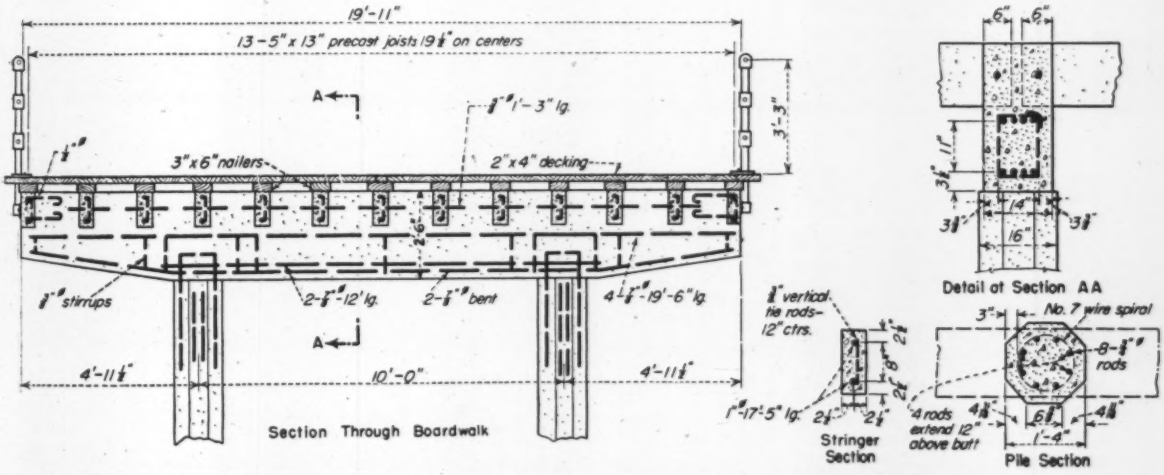


Fig. 1. Details of the boardwalk construction are given in sections through the structure and its major components. Spaced 18 ft. apart, bents consist of 14-in. wide by 30-in. deep cast-in-place combined caps and girders, tapering to 23-in. deep at the ends, and 16-in. precast concrete piles.

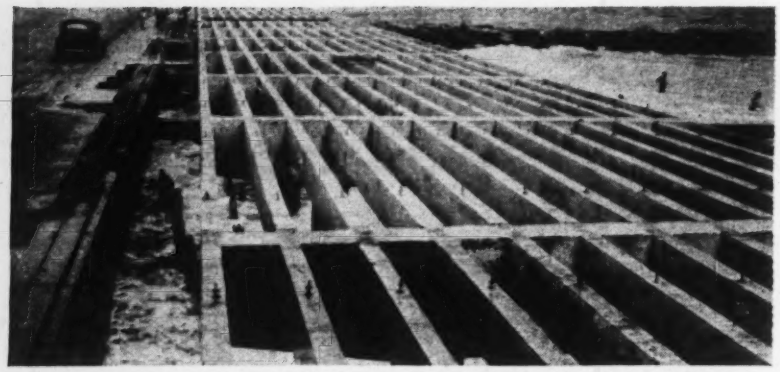


Fig. 2. Supported on precast concrete piles, the new section of the Atlantic City boardwalk has precast concrete stringers firmly set in cast-in-place pile caps.

and no concrete is placed between the abutting stringers. While at non-expansion bents the outside joists are tied into the caps with hooked dowels, at expansion joints the fascia beams are tied to adjoining stringers 4 ft. from the center of the bents with galvanized ½ x 4-in. steel straps.

The contract was let early in 1946 for a lump sum of $156,480 for the 2,800 ft. of new structure, exclusive of wood deck, to the Anthony P. Miller Co., Atlantic City, which also held a $40,740 contract for the repair of several sections of the older type boardwalk partly damaged by the hurricane. Casting of the piles and stringers was sublet to Formigle Bros., of Berlin, N. J., which trucked the units 50 miles from its home plant to the job. Concrete averaging 6,000 lb. per sq.in. at 28 days was obtained in all precast units. The structure was designed by city engineer George R. Swinton. William F. Casey is director of public works.

Accident Prevention Saves Millions On U. S. Government Contracts

Accident prevention requirements incorporated as an obligation in all contracts of the Corps of Engineers, U. S. Army, since shortly after Pearl Harbor have saved the government millions of dollars, declared Lt. Gen. Raymond A. Wheeler, Chief of Engineers, before the construction section of the National Safety Council at its recent meeting in Chicago, during the 34th National Safety Congress. Audit of 182 cost-plus-a-fixed-fee contracts shows a net return to the government of $10,067,168 out of workmen's compensation premiums totaling $26,593,000, said General Wheeler, and estimates indicate savings of $87,500,000 for the full list of projects from 1941 to 1944, involving 3½ billion man-hours.

Prevention campaign permanent

"In the Corps of Engineers," he asserted, "accident prevention is no temporary campaign, fostered by wartime activities. It is as permanent as the organization itself. We engineers know it to be good, sound, business economy, apart from the very real human elements involved." For the future, he promised, the full measure of accident prevention would be applied in the flood control and Veterans' Administration hospital programs, as well as in all other work undertaken by the Corps of Engineers.

Pointing to the record, he showed how the accident frequency rate of private contractors had declined after inclusion of mandatory safety and health requirements in all contracts of the Corps of Engineers. In 1940 the accident frequency rate on these contracts was 55.87; it dropped progressively through succeeding years to 9.25 in 1945.

Fatigue causes accidents

At the same session, R. A. Beckwith, vice president and chief engineer, Koehring Co., Milwaukee, emphasized fatigue in men and machines as one of the prime causes of construction equipment accidents. He succinctly described a number of common failures resulting from lack of attention to conditions which tire machine operators or overstress metals.

Necessity for conserving limited manpower, as well as humane consideration for fellow workers, was laid down by John Dahlman, vice president, Dahlman Construction Co., Milwaukee, as a compelling reason for contractors to follow safe practices in construction today. On two counts, contractors must push safety programs this year, he said. "Average age of skilled construction workmen is over 55. The older men work harder and tire more quickly, and the younger ones are more careless and more reckless. Both require safety training and supervision from contractors."

In a preceding session, dramatizations of investigations in a project manager's office following three typical accidents were presented by a panel of actors under the direction of Otto S. Holmskog, chairman of the program committee, and Joseph A. DeLuca, E. I. du Pont de Nemours & Co., both of whom participated. Each sketch evoked audience discussion on the major points illustrated.

Safety efforts prove fruitful

Edgar N. Goldstine, consulting safety engineer, San Francisco, credited safety efforts of the last 20 years for reducing the accident frequency rate during that time from 120 to 20 and the severity rate from 12 to 2. In promoting greater acceptance of safety on construction, he recommended publicity which gives specific information on accident causes and prevention, rather than general statistical data.

Officers re-elected to lead the construction section for the next year are Lloyd A. Blanchard, Washington, D. C., general chairman; Frank J. Crandell, Boston, Mass., vice chairman; and Harry J. Kirk, Washington, D. C., secretary.

PROBLEMS INVOLVED IN DEVELOPING . . .

A Plant to Make Precision-Built Products

***Contents in Brief**—Completely air conditioned and designed for maximum efficiency, General Motor's new diesel equipment plant at Grand Rapids, Mich., typifies the contemporary planning required to develop and design a manufacturing plant for small, precision-made products. When completed, the plant will manufacture the fuel injectors for all GM diesel engines.*

STARTING with the requirements for complete air conditioning, with careful control of temperature and humidity, and the eilmination of dust, the new fuel-injector manufacturing plant of the Diesel Equipment Division of General Motors Corporation, at Grand Rapids, Mich., embodies a great number of innovations in contemporary plant design. Although many of the installed facilities will add much to the comfort and convenience of the workers, the principal thought was to develop a plant designed for maximum efficiency and the greatest quality control possible.

So exacting are the machining operations and permissible tolerances (down to one thirty-millionth of an inch) involved in manufacturing the diesel fuel injectors, that neither dust nor rust-producing humidity can be tolerated within the manufacturing area of the plant. Under improper conditions of humidity even the saline content of a workman's finger print might produce damaging rust on a highly machined part of the completed injector.

Thus, it was decided that the entire one-story factory portion of the plant should be windowless, covered with a well insulated and waterproofed flat roof, and equipped with fluorescent lighting throughout. This same high degree of design is extended throughout the two-story office building and power plant which were built as an integral part of the plant. In addition, the offices and employee facility rooms have acoustic ceilings of the perforated metal pan type with sound absorbent filler.

Although the architectural design of the plant is purely functional, the completed structure presents a most pleasing appearance. A single row of sealed windows in each story of the office building breaks the monotony of an otherwise plain brick-faced, concrete-block wall, while penthouses atop both the office building and factory add height to the structure. These penthouses contain air conditioning units, including electrostatic air filters.

Construction of this up-to-date manufacturing plant was begun in September, 1945, and the production lines for fuel injectors were started Aug. 30, 1946. Final completion is scheduled for some time late this year.

Under full production, some 2,000 workmen will be employed in the factory portion of the plant. Fourteen different sizes of injectors will be made, varying in size from those in the smallest tractor to the largest General Motors diesel power unit for locomotives. The plant also is making some high-pressure nozzles for the P80 jet-propelled airplane.

Much planning necessary

A great deal of advance planning must necessarily be done before structural designs can be started on such a plant as the Diesel Equipment Division's plant at Grand Rapids. A suitable site must be found of sufficient size to not only accommodate

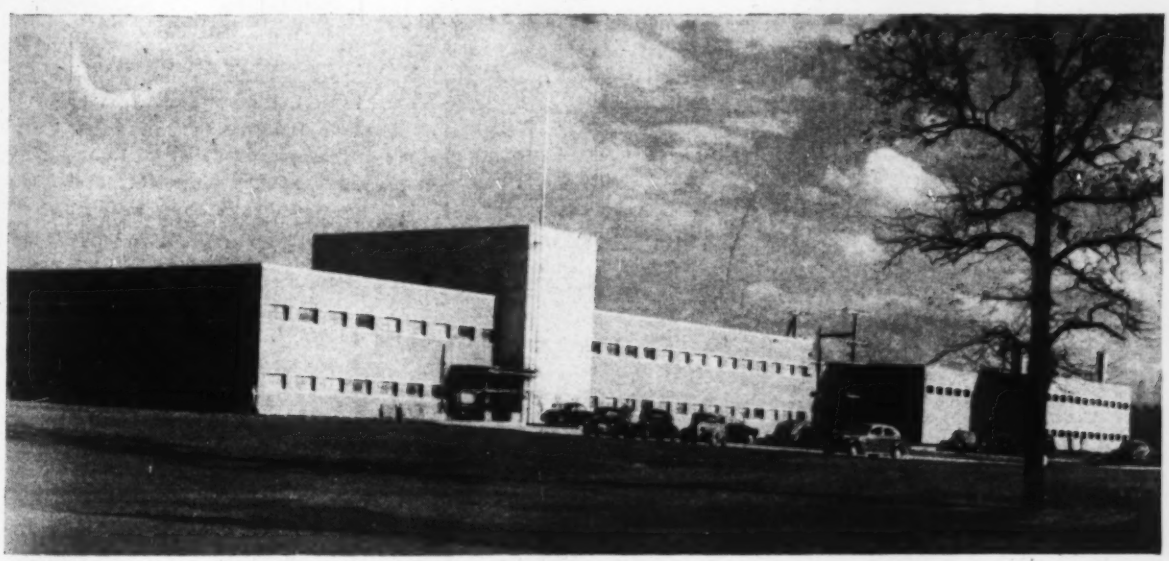


Fig. 1. Fuel injectors for all General Motors diesel engines will be made in a new, completely air-conditioned plant.

Fig. 2. Filtered air, closely controlled temperature and humidity, and a high degree of fluorescent lighting are of paramount importance in the manufacturing area of the plant.

the proposed plant, but to permit future expansion as well. Adequate parking space is of utmost importance and usually exceeds by far the area covered by the plant.

Thorough preliminary study

Preliminary studies must be made of the adequacy of labor, and the type of workman to be found in the area under consideration. No such problems are involved, however, at Grand Rapids since the company had already been manufacturing diesel injectors in that city, in a leased, 40-year old factory formerly devoted to furniture manufacturing.

Of singular significance is the fact that most of the workers are women. During the war, they were trained to do the painstaking operations involved in the manufacture of small arms and, with the advent of peace it was little trouble to train them to make the several precision parts that go into the assembly of an injector.

In locating the site for a new manufacturing plant, accessibility of truck and rail service is of paramount importance, both from the standpoint of raw materials and finished products. Then, too, the availability of water supply, gas, electricity and sewer lines are important factors that must be carefully considered. The relative costs of these services also enter into the economic picture, as do the tax rates of the city and state in which the new enterprise is to be located.

Upon the conclusion of these preliminary studies the next operation is to make a detailed analysis of the number of products to be manufactured, and arrive at an approximate rate of production. From the number of operations required in manufacturing and assembling the products, machine loads are established with subsequent plans for floor layout resulting in total space requirements for the manufacturing plant.

Coincident with determining the amount of factory floor space required, the flow of material through the plant must be decided, including the sequence of processing it.

Provisions for enlargement

One extremely important factor in plant design is the possibility of future expansion. The Grand Rapids plant, located on an 80-acre tract just outside the southwest limits of the city, was laid out so the manufacturing portion can be expanded in two directions should the need arise. Ground space also is provided to expand the offices and employee facilities as necessary. In this connection, the power plant was located at one corner of the front of the building so it will not interfere with any plant extensions.

Upon completion of the foregoing studies, architectural and structural designs are prepared, based on the requirements of the factory. In other

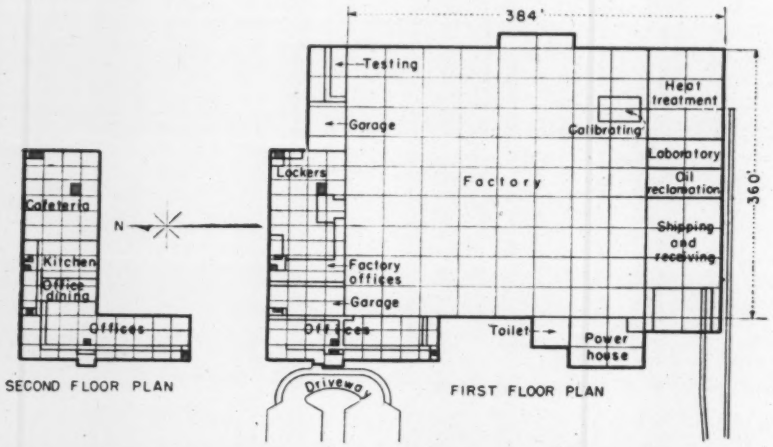


Fig. 3. Efficiency of operation is assured by a well-designed plant layout. Cafeteria, dining room and kitchen are located on the second floor.

words, the functions of the plant are determined first, and the building designed to fit.

Office and personnel facilities

Having decided upon the rate of production and the machine loads required, the next step is to determine the total number of workmen needed in the factory. At the same time a detailed estimate is made of the number of office workers needed.

Then, knowing the total number of craftsmen, office workers and management needed to operate the plant at its peak efficiency, architectural and structural designs can be made on the non-production facilities necessary. These include office space; cafeterias; toilet, shower and locker rooms; first-aid and emergency hospital facilities and plant protection.

In locating the several personnel accommodations it is of utmost importance to set up flow diagrams showing how the employees enter the plant and proceed to their work, and how they leave when their day's work is finished. This is an invaluable aid in locating the locker rooms and offices both with respect to the manufacturing part of the plant, and with each other.

The office building at Grand Rapids is L-shaped, extending 217 ft. along the west and 100 ft. along the north side of the plant. The first floor is devoted to executive offices, sales, purchasing and production management, employement office, medical department, personnel management and a garage for company-owned cars.

The second floor houses the offices of the chief engineer, plant engineer, auditing department, engineering department, cafeteria and a small dining room.

Large factory area needed

Some 138,000 sq. ft. of floor area is provided in the factory, which is a single room measuring 384x360 ft. It is a structural frame building with steel columns spaced 48x40 ft., with 48-ft. and 40-ft. span roof trusses carrying 20-ft. rolled beam purlins to support the roof. Truss depths vary a maximum of 5 in. to provide drainage for the otherwise flat roof. The 48x40-ft. column spacing was determined from the requirements of manufacturing and the layout of the production lines. Moreover, it was believed that such a spacing would give the most unobstructed floor area at the least cost. Expansion joints are provided in the floor and roof near the two center lines of the factory area.

Fig. 4. Air conditioning and electric bus ducts are cradled in the factory roof trusses (top), while all office floors are surfaced with asphalt tile (bottom).

Bottom chords of all trusses are horizontal and are located 15 ft. above the factory floor. An intensity of 35 foot candles is provided at working level throughout the factory by some 2,550 fluorescent lighting assemblies each consisting of two 100-watt, 60-in. tubes. Lighting fixtures and electric conduit are suspended from messenger cables clamped to the bottom chords of the trusses. Air conditioning and electric bus ducts are cradled in the trusses.

No attempts were made to enclose the wall columns either along the exterior walls or between the factory and office building. The columns set out into the factory, snug against the concrete block walls, which are faced on the outside with brick. A solid concrete block wall, except for three door openings, separates the factory and the office building.

The entire floor of the factory is wire mesh reinforced concrete, 6 in. thick plus 1½ in. of cement-sand-

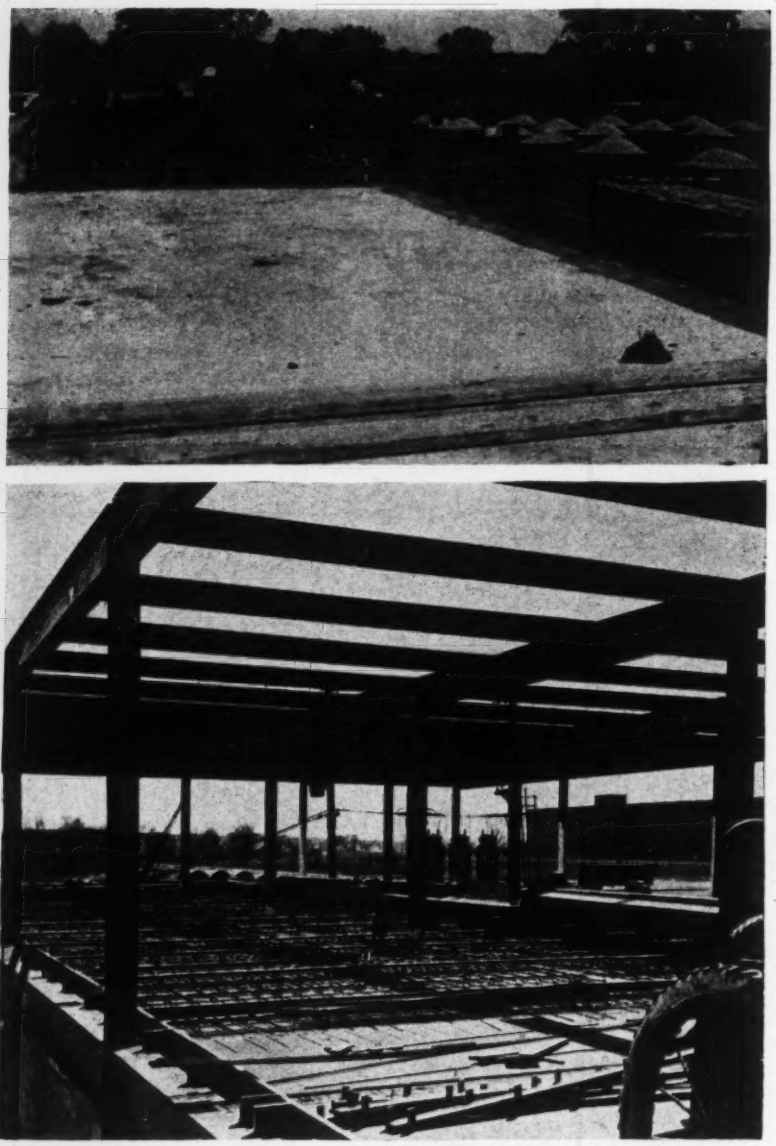


Fig. 5. Roofs are 20-year bond steel deck carrying a vapor seal, rigid insulation and gravel surface (top), while floors are continuous concrete slabs on steel framing (bottom).

gravel topping, resting on previously compacted soil and sand. Columns rest on individual concrete pedestals directly beneath the floor, on small reinforced concrete footings. Maximum foundation design loads were 3 tons per square foot.

Concrete topping on floors

Concrete topping for floors consisted of equal parts, by volume, of cement, sand and stone chips graded from $\frac{1}{8}$ to $\frac{3}{8}$ in. in size. After the structural slab had been screeded and leveled and permitted to partially harden, it was roughened with a fiber broom. This sweeping removed all laitance and provided a satisfactory surface for bonding of the topping. Then a thin coat of neat cement was applied, following which the topping was placed using wood leveling strips at frequent intervals.

All excess surface moisture was removed from the concrete topping by absorptive cotton quilts, placed directly on the fresh concrete, followed by adding a thin coating of sand-cement drying agent as necessary. After the drying agent had been removed, the topping was thoroughly compacted with a disk-type, motor-driven float, steel-troweled to a smooth, impervious surface, and kept thoroughly saturated for ten days.

Considerable care was taken to secure a well insulated, waterproof roof free from leaks and condensation. Structurally, it is a steel deck roof spanning between the rolled-beam purlins and carrying insulation and a 20-year bond built-up roof topped with gravel. The insulation course was made up of a two-ply vapor seal and two plies of rigid insulation.

The vapor seal was made by applying a total of 40 lb. of hot pitch per 100 sq. ft. of roof area, swabbed under, between and on top of, two layers of felt. The two-ply, rigid insulation was installed by first coating the vapor seal with 40 lb. of hot tar per 100 sq. ft. of area, then pressing a layer of 1-in. insulation board firmly into the hot tar, with end joints staggered. This was followed with another application of hot tar at the same rate as before into which was embedded a second layer of 1-in. insulation board, with all joints staggered with those of the preceding layer. Then the entire surface was coated with 70 lb. of hot tar per 100 sq. ft., into which was embedded about 400 lb. of pea gravel per 100 sq. ft. of area. All roofs were designed for dead load plus a live load of 40 lb. per sq. ft., using a factor of safety of four.

Soundproof calibrating room

Two 48-ft. wide bays extending across the entire south end of the factory (360 ft.) will house the receiving and shipping department including facilities for shipping by both rail and truck. Part of this space will be devoted to a metallurgical and heat treating department with laboratory, and a room for the reclamation of oil used in manufacturing the injectors. A sound-proof calibrating room will occupy space within the factory area.

In addition to being air conditioned, the two-story office building offers an optimum of working comfort for the 275 salaried employees in that department. For instance, all ceilings except those in the toilets, showers and locker rooms are finished with acoustic treatment, and the tabulating department, ordinarily a rather noisy place in any large office, has been acoustically treated throughout.

Fluorescent lights, numbering 110 in the corridors and above the stairs and 710 throughout the rest of the office building, are recessed flush with the ceilings. Each fixture contains two 40-watt, 48-in. fluorescent tubes. Floor surfaces in the locker rooms, showers and toilets are non-slip, terrazzo finish, and walls are tiled.

All other floors are grease-proof, asphalt tile on continuous concrete slabs. Windows, necessarily are non-operative in view of the air condition control. Should it be needed, a small amount of additional heat can be secured from a hand-controlled steam radiator mounted against the exterior wall of each office.

Like the factory, the office building is of steel frame construction, with column spacings of 20x24 ft. The roofs are the same except the two layers of insulating board above the vapor seal are only ½ in. thick. Ceiling heights are 10 ft. in the offices and 8 ft. in the corridors. The extra 2 ft. above corridor ceilings contain the large air conditioning ducts.

Interior walls are hollow tile and plaster. Window frames are steel set into steel frames. Sills and lintels are Indiana limestone. Practically no timber of any kind will be included in the structural make-up of the entire plant, when completed.

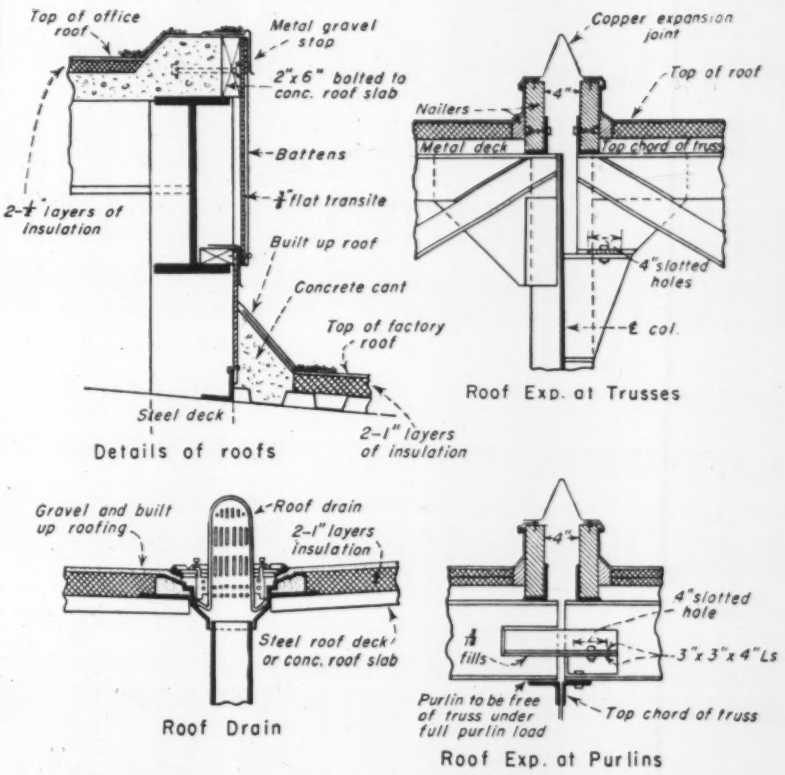


Fig. 6. Roofs were sealed against moisture, with particular care being taken at the junction between office building and factory (upper left) at expansion joints over trusses, at the roof drains and over purlins.

Free flow of personnel

Ingress and egress for the factory and offices have been simplified by two corridors on the ground floor, one of which runs the full length of the building. Factory workers enter direct to locker rooms, showers and toilets from which they pass on into the factory area.

The main corridor connects with all offices on the ground floor, with stairs leading to a similar corridor on the second floor. Entrances for the employees are located on the north side of the building, adjacent to the parking area.

One unusual feature of this efficiently-designed plant is the arrangement for receiving and processing new employees. They enter a small employment office located adjacent to the employees' entrance. Two small toilets and lavoratories have been provided, just off this waiting room, for the convenience of the applicants.

Following a successful interview and the hiring of an employee, he immediately passes into an adjoining room for fingerprinting and photographic identification. Next he proceeds to the medical department for a complete physical examination, following which he is routed to the factory to begin working.

No expense was spared in equipping the first-aid and medical department of the plant. It has two examining rooms and is staffed with a full-time physician, laboratory assistants and a registered nurse on duty at all times during operation of the plant. The medical department contains an emergency operating room, an X-ray and developing room, a diathermy room and one for making complete eye examinations.

One point of note is that no differentiation has been made between the conveniences provided for the factory worker and the office employee. Their locker rooms and toilets are identically equipped and a large cafeteria has been provided capable of seating 800 persons. There also is a snack-bar, just off the main cafeteria, that will seat 140 people, and a small dining room for guests—all located on the second floor of the office building.

Separate shower and locker rooms are provided for the cafeteria employees. The kitchen and dishwashing rooms have concrete floors and tile walls, and one small cork-lined room has been refrigerated for the collection of garbage, prior to its being disposed of by truck.

Engineering personnel

All designs and construction specifications for the plant were prepared by Allen and Kelley, architects and engineers, of Indianapolis, Ind., under contract with the Argonaut Realty Division of General Motors Corporation. F. G. Tykle is general manager of Argonaut, G. D. Mitton is chief engineer and W. O. Margrove, field engineer in charge of the project. Owen, Ames and Kimball, of Grand Rapids, Mich. are the contractors.

G. F. Runchey is general manager of the new plant. C. W. Truxel is chief engineer, and H. R. Laubach is works manager.

Distributed Reinforcement in Pavements Found Advantageous in Rhode Island

Lee V. Spencer
Road Construction Engineer, Division of Roads and Bridges
Rhode Island Department of Public Works

***Contents in Brief**—Continuing surveys of the number of cracks per mile in concrete pavements in Rhode Island indicate the structural integrity of the pavement slabs is materially increased by distributed reinforcement.*

IN RECENT MONTHS state highway engineers and others directly responsible for the design of highways to be constructed under the provisions of the Federal-Aid Highway Act of 1944 have been giving particular attention to various features of design that seem likely to have a direct bearing on the overall performance and life of such highways. Whenever pavements of the rigid type are decided upon, the question immediately arises as to whether distributed reinforcement should be included in the concrete or whether plain concrete of thickened cross-section should be employed.

It is very generally recognized by highway engineers that one of the basic problems involved in proper design of concrete pavements is to insure structural integrity by attaining satisfactory control of cracking rather than to accomplish complete prevention of cracks. Since steel, when included as reinforcement for highway pavement slabs, cannot be used in such amount, from an economic standpoint, as to guarantee absolute structural performance of the pavement slabs, reinforcing steel functions to insure such structural integrity in two ways: First, through the prevention of localized shrinkage, which occurs in the concrete during the hardening processes and, second, by maintaining the parts of a slab unit in intimate contact should cracks develop.

Any crack that develops in a plain concrete pavement being susceptible to the accumulation of detritus and other foreign matter upon contraction of the concrete, shortly becomes a joint that remains more or less permanently open. However, if effective control is practiced by means of which each individual slab unit is protected against the effects of erratic cracking through the inclusion of steel reinforcement thoroughly bonded to the concrete, any incipient cracks will be held tightly in contact. Such tightly closed cracks are permanently resistant to shear, will create neither free edges nor corners and the slab unit remains substantially as sound structurally as it was prior to the first appearance of a crack.

Continuing crack surveys

Recently a number of state highway departments have given particular attention to surveys of the extent to which cracking of concrete pavements has taken place. In some cases, these surveys have been made regularly over a long period of years. With the assistance of such long-time surveys, which are to be considered as much more authoritative than occasional and frequently unrelated surveys, the state highway departments have been able to relate the amount and type of cracking to the factors responsible therefor.

The Rhode Island Division of Roads and Bridges, beginning with 1925, has made careful cracks surveys annually over its 545 slab-width miles of portland-cement concrete pavements. Table I gives the results of the concrete pavement crack survey, listing the average number of transverse cracks that have developed per mile of single-slab width. A direct comparison is possible between plain concrete sections (laid in 1921) and sections reinforced with either bars or wire mesh laid during the years 1922 through 1942. For the most part, all sections had been laid for a sufficient period of years to make it possible to draw definite conclusions as to comparative performance.

The following conclusions result from the annual observations made by the Division of Roads and Bridges:

1. The number of transverse cracks per mile of slab width in the bar reinforced sections (length 11.78 miles) was somewhat less than one-third of the number which developed in the plain concrete sections.

2. There was no essential difference in the number of transverse cracks in the wire mesh-reinforced sections, constructed since 1927, as compared to those which developed in the bar-reinforced sections constructed in 1922-23.

3. Where concrete pavements have been laid directly over existing water-bound macadam as a base, the entire length of such projects has a very large number of cracks in comparison with other sections laid on natural subgrade. In one such section built over old macadam, 1,500 ft. long, there were found 60 cracks whereas on the remainder of the section, 15,400 ft. long, built on new gravel foundation, a total of only 67 cracks was noted. This would appear to be due to the fact that the foundation under the old macadam does not drain properly, thus causing frost action.

4. Practically all projects had expansion joints at 90 ft. c.c. except those most recently built in which the expansion joints were at intervals of 73 ft. 6 in. Notwithstanding the pres-

TABLE I—CONCRETE PAVEMENT CRACK SURVEY ON RHODE ISLAND CONCRETE PAVEMENTS

Average Number of Transverse Cracks Per Miles of Slab Width

Year Paved	Width of Road (ft.)	Total miles of Slab Width	Slab Thickness	Reinforcing Type	Weight /100 sq. ft.	Age in Years 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1921	18	2.29	6″ 8″ 6″	None	——	—			72	73	100	101	101	105	114	125	126	130	135	141	145	150	Survey Discontinued				
1922–23	18	11.78	6″ & 7″	Bars	100#	—	15	18	23	28	29	30	31	33	34	35	38	45	48	50	48	49	51	55	57	59	60
1924–25	18	41.44	7″	Wire Mesh	65#	32	41	49	62	74	79	88	96	105	115	127	138	121	107	103	107	109	111	114	—	—	—
1924–26	18	43.42	8″	"	65#	13	26	32	33	38	42	47	50	54	61	64	69	71	72	73	77	59	62	—	—	—	—
1926	18	4.60	7″	"	42#	7	11	19	25	41	41	47	48	53	65	66	66	73	73	83	83	87	89	—	—	—	—
1926–28	18–40	55.23	8″	"	42#	5	9	16	22	30	36	44	50	58	61	63	65	53	60	75	80	63	81	—	—	—	—
1927–29	20	24.56	8″	"	42#	3	5	7	9	10	15	20	25	29	31	33	36	37	38	40							
1929–31	20–40	46.38	8″	"	42#	9	15	17	24	32	36	39	42	26	29	52	53	58	53	53	84						
1930–36	20–40	145.96	8″	"	42#	2	3	7	14	19	23	24	24	31	36	37	40	42	49								
1936–42	20–47	97.46	8″	"	46#	2	4	6	9	14	22	27	28														

ent-day tendency on the part of some engineers to eliminate expansion joints and substitute contraction joints at close intervals, shorter slabs did not account for any appreciable decrease in the number of transverse cracks. In one projects, eight years of age and two miles in length, with expansion joints at 90 ft. c.c. only six transverse cracks were noted, at least 50 percent of which were located over culverts. In other projects 12 to 18 years old, with 90-ft. expansion joints, there were frequent stretches 1,000 to 2,000 ft. in length, without any cracks.

5. One project in particular had expansion joints located at closer intervals. Observations indicated that cracks had developed as follows:

No. of Slabs	Length of Slabs	No. of Transverse Cracks
16	40 ft.	None
280	50 ft.	47
36	60 ft.	9
24	70 ft.	7
4	80 ft.	4
132	90 ft.	31

6. On one particular contract 2.5 miles long, known as Nooseneck Hill Road, constructed in 1942, no distributed reinforcement was included. Transverse cracks average eight per mile of slab, whereas on a previous contract on the same highway, built in 1940, and in which wire mesh reinforcement (46 lb. per 100 sq. ft.) was incorporated, the number of transverse cracks averaged one per mile of slab.

7. In general, cracking of concrete pavements is most likely to occur over pipe and box culverts, over bridges, at ledge locations, at intersections of cut and fill, at or near manholes, and watergates, at locations were new pavement is placed directly over existing water-bound macadam and over locations of heavy fill, particularly over swampy locations.

On one project, 18,450 ft. in length, there was observed a total of 100 transverse cracks. For a distance of 450 ft. the pavement was laid over a swampy fill. Forty-seven cracks were observed in the area over the swampy fill, 19 over culverts and the remaining 34 were observed in a distance approximating 18,000 ft.

Obviously, the advantage of using distributed reinforcement in this project and essentially all others in the Rhode Island State Highway system, has been reflected in effective control of the amount of cracking and in minimizing the number of cracks over areas in which plain concrete might be expected to exhibit excessive cracking.

Rental Housing Attracts Millions In Insurance and Savings Bank Funds

Current rental housing developments have boosted to $325,000,000 the total of insurance company and savings bank funds invested in housing throughout the country. Much of the new investment has been authorized by recent state legislation, according to the National Association of Housing Officials.

The trend toward such investment, spurred by the unprecedented housing demand, is even more rapid than housing authorities had anticipated. The association recently cited a report specifying that a $150,000,000 new investment is being made in housing by insurance companies, in addition to the $125,000,000 of insurance funds previously invested in housing. Savings banks currently are making similar investments totaling $50,000,000.

Most recent enactments enabling use of insurance money to finance housing projects were passed by Louisiana in July and by Missouri last spring. Rental housing financed with insurance funds is provided for also in legislation enacted last year by Illinois, Minnesota, Massachusetts and Pennsylvania.

Further, an increasing number of insurance and savings-financed housing projects are being created under provisions of previously adopted legislation in New York, New Jersey, California and Virginia. General provisions for similar investments were enacted last year in Connecticut and Wisconsin though no projects have yet been announced for either of those two states.

Insurance-financed projects are becoming numerous on both coasts. New York's redevelopment companies law grants partial tax exemptions to developers of Stuvyesant Town and Riverton, both low-rent projects now under construction in New York City. Together with Peter Cooper Village, on which construction is beginning, the three New York projects total some 10,000 housing units.

In California, the insurance-financed housing developments of Parklabrea in Los Angeles and Parkmerced in San Francisco are just being completed.

Comment and Discussion

Readers' opinions on matters that concern engineers and contractors

Turbine-Generator Foundations

Sir: "Some Essentials of Turbine-Generator Foundation Design" in *ENR* Sept. 5, 1946, vol. p. 316, is a valuable contribution and affords a good guide for the general layout and design of individual members of the turbine-generator pedestal. However, the basic design assumptions given in this article vary to a great extent from the assumptions of other manufacturers, and these assumptions in turn differ from those used by design offices engaged in power plant work.

For example, General Electric Co. recommends increasing the machine load 25 percent for 1,800 r.p.m. machines and 50 percent for 3,600 r.p.m. machines for impact. Westinghouse Electric Corp. recommends the weight of the turbine and generator plus the reactions from the condenser plus 35 percent of this total for impact. Others use the weight of the machine plus 100 percent for impact.

For transverse loads applied at the center line of shaft, General Electric Co. recommends 50 percent of the rotating weight for 1,800 r.p.m. machines and 100 percent for 3,600 r.p.m. machines. (The rotating element is generally between 1/4 to 1/6 of the total machine weight.) Westinghouse Electric Corp. recommends 25 percent of the total machine weight. Others use as high as 50 per cent of the total weight.

In the case of longitudinal loads applied at the center line of shaft, General Electric Co. recommendations are the same as for transverse loads. Westinghouse Electric Corp. recommends 10 percent of the total weight of the machine. Others use 25 percent of the total weight.

It has been the experience of the writer that with reinforced concrete pedestals, if the limiting deflection is kept at 0.02 in. (and not close to resonant deflections), the individual girders and columns will have a low stress, even with the most conservative assumptions of loading. Also, since the conventional design analysis is difficult to apply, it may be found advisable to determine the deflections of the girders for fixed end supports and for free end supports and approximate the actual deflection from this range of values.

Among other factors the designer should give attention to are:

1. The eccentric loading of the deck which introduces a torsional shear in the girders. General Electric Co. recommends that no reliance be placed on concrete for shear and that closed stirrups be used. 2. The unequal shortening of the columns, which introduces high moments in the girders. Equal shortening should be provided in the best manner possible.

H. Irving Sigman
Brooklyn, New York

Favors Joining the NSPE

Sir: Reference is made to William Stack's letter "Not a Profession", in the Oct. 17 issue, vol. p. 538. This letter attracted my attention because I, too, hold two civil engineering certificates and one land surveyor's license and was a safety engineer on heavy construction both for the War Department and for a large insurance company.

Mr. Stack's cynicism and bitterness is justified and the attitude reflects long periods of nursing many hurts.

After experiences almost identical with his, I had just about arrived at the same answer, when I heard of the National Society of Professional Engineers and its aims. Once more I hoped and once more I believed. I applied for membership and was accepted and have never regretted the action since.

Mr. Stack's letter indicates that he is a thinker and a doer as well as an engineer and we in NSPE need him; therefore I suggest that he contact Paul H. Robbins, executive director, NSPE, 937 National Press Building, Washington, D. C. for the address of the chapter nearest him or with the end in view of becoming a member-at-large, and I feel sure that he will have an association with engineers of kindred spirit and thought, and his bitterness will be converted into channeled aggressiveness-for-good that will terminate in the end, that his letter indicates, he so desires.

John P. Goggin
Civil Engineer,
Clare, Mich.

Building Inspection by Affidavit

Sir: A weird proposition is placed before your readers in the plan reported on vol. p. 104 of *ENR* for July 25, 1946 dealing with a new way to enforce (?) building codes that is now employed by some cities in the state of Washington.

The idea of reducing building departments to a state of rubber-stamp mockery is too fantastic to mislead anyone familiar with building construction problems. However, others may be misled by the supporting argument claiming savings to taxpayers.

But building departments usually are not paid for out of the general tax fund. Mostly they are self-sustaining. The cost is borne by those primarily concerned. The owner pays for services which he is entitled to receive in protection of his own project. Competent designers welcome a check. They admit that even good men make mistakes and they benefit from the protection which the inspection department gives against competitors willing to "skin the job." Codes, at best, are subject to interpretation and an unbiased clearing house is essential to uniformity and standardization. In this capacity an adequate building inspector's office serves designer, builder and public alike.

From initial application for permit, through the zoning, plan checking and field inspection the building office assures a logical sequence. Under the proposed affidavit substitute, with no check, no inspection and no attested records, when structures fail and fall the courts may be busy attempting to establish responsibility.

With human nature what it is, to dispense with all inspection control on construction would be like trying to do away with all traffic control as soon as all automobile drivers qualified for licenses.

Chas. P. Morgan
Chief Building Inspector,
Long Beach, Calif.

From Field and Office

WORKING PROBLEMS AND TIME-SAVING METHODS FOR ENGINEERS AND CONTRACTORS

Army Engineers Develop Cone Penetrometer

The U. S. Army Engineers recently removed from secret classification a cone penetrometer developed by the Engineer Board for use on reconnaissance in hostile areas as an aid in determining the ability of different types of soil to accommodate the passage of mobile equipment. The new light-weight instrument, which permits the shearing resistance of low-bearing soils to be measured, is a modification of a device developed by the North Dakota State Highway Department. Since the war ended, studies with the tool have continued, as the device is expected to have peacetime value.

The cone penetrometer is a spring-loaded instrument for forcing into the soil a 30-deg. cone which has a 2-sq. in. projected end area. In using the instrument, the cone is first forced downward until the top of the cone is level with the surface of the soil, then a load is applied slowly against the compression spring until the cone begins to move. When the cone has penetrated to a depth of 3 in. a reading is taken.

This procedure is repeated in 3-in. increments to the desired total depth. The load in pounds, as recorded by the instrument is the resistance of the cone to penetration as indicated by the spring compression. The recorded load divided by the area of the end projection of the cone gives a value which is an empirical indication of resistance of the soil to shear in the zone penetrated.

Fig. 1. Forcing the cone on the lower end of the penetrometer into soil under study gives a reading on the spring gage that serves as a guide in determining the shear value of the soil at various depths.

Fig. 2. Cone type penetrometer developed by the Army Engineers during the war for quick determination of soil characteristics in enemy territory.

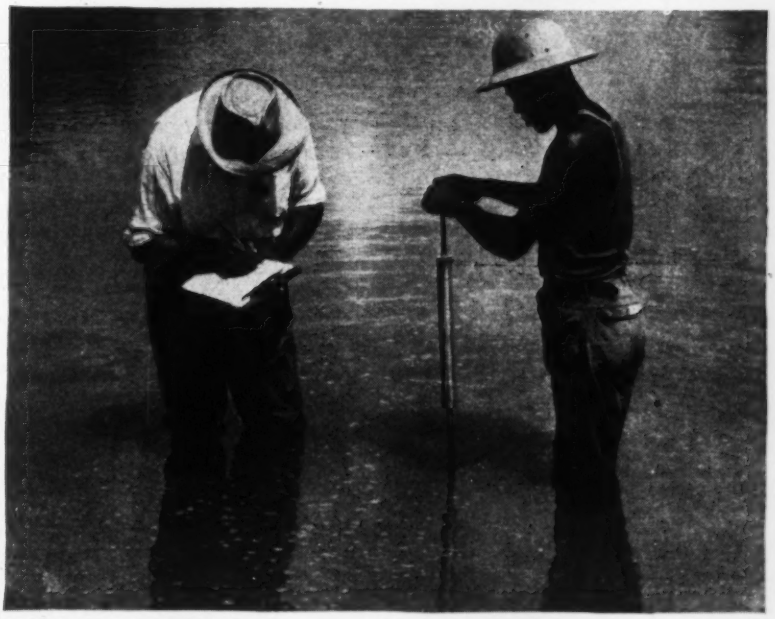


Fig. 3. The instrument is also of value in measuring shear resistance of soils covered with water.

The Engineer Board, the Vicksburg Waterways Experiment Station and the Office of the Chief of Engineers cooperated on development of the cone penetrometer.

Adjustable All-Steel Form for Concrete Steps

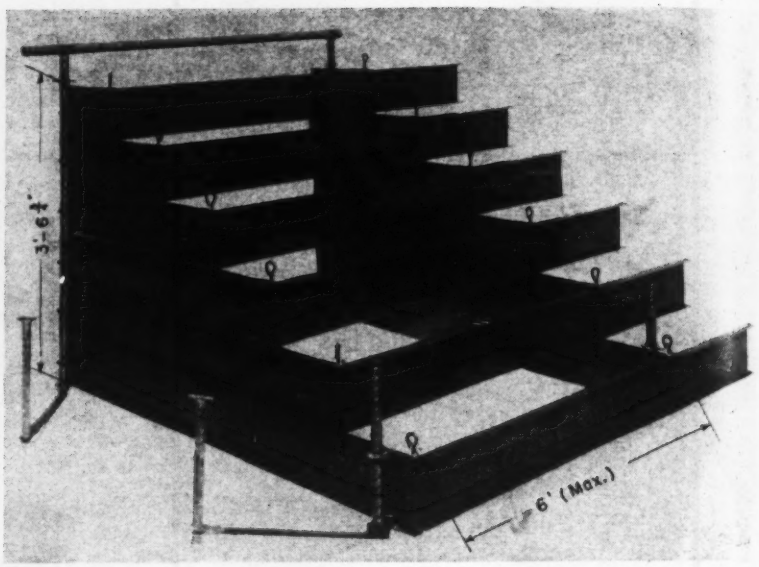
Uncertainties of sagging treads and bulging risers in cast-in-place concrete step construction are reported to be eliminated by an adjustable all-steel assembly developed by Adam Pollman, building contractor, Milwaukee, Wis. The forms can be assembled in 15 minutes and their structural arrangement insures all steps being level and the treads and

risers uniform. While the height of riser and depth of tread are fixed, the width of stairway may be varied from 2 to 6 ft., in increments of 6 in.

Structurally, the assembly consists of a number of progressively shorter channels set edge-on-edge to form the sides, and channels of uniform length for the risers. All channels are $7\frac{1}{8}$ in. wide, weighing 3.67 lb. per lin. ft. Side channels are held against relative displacement by dowel pins. Risers are connected to the front ends of the side channels by $\frac{3}{8}$-in. pins which pass through holes in clips welded to the top flanges of the side channels and any one of the series of holes in the flanges of the riser channels.

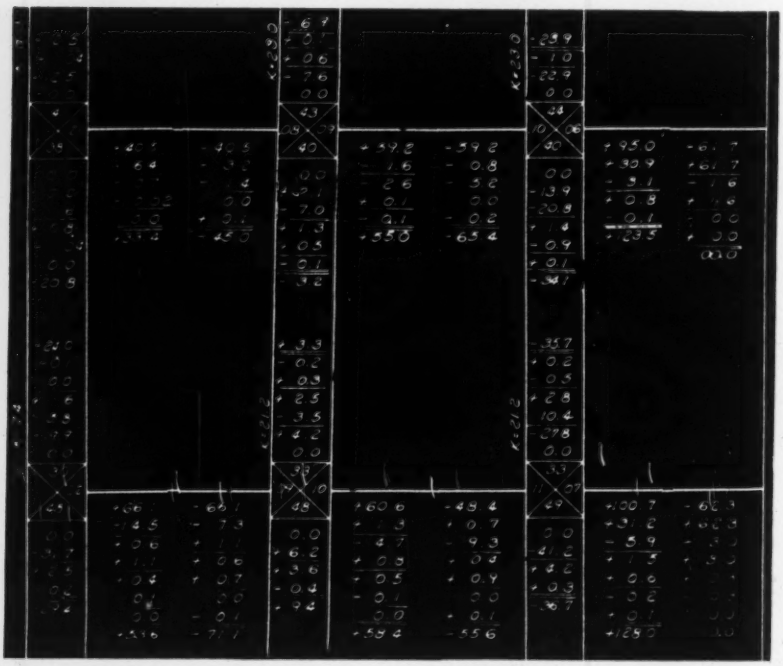
A feature of the form resides in the use of helically deformed tubes resting on pads and threaded in collars attached to the flanges of certain of the side channels to provide convenient leveling jacks. At the rear these tubes extend the full height of the stairway, with their upper ends rigidly connected by a length of the same tubing. This cross piece is threaded in collars to which have been welded pins that extend down into the upright tubes.

Total weight of structural steel required to cast a five-step assembly 6 ft. wide is 190 lb. The concrete steps are cast in place directly on previously shaped and compacted ground, and treads are finished by trowel, wood block and stiff brush.



Width of step may be varied from 2 to 6 ft., while helically deformed tubing, resting on metal pads, permits quick and accurate leveling.

MOMENT DISTRIBUTION FORM



The time-saving feature of the above form for distributing moments in building frames is the arrangement of the figures in vertical columns, thus obviating the necessity of shifting the paper in order to reach horizontal columns. Distribution factors are given at the intersection of beams and columns, and fixed-end moments of corresponding beam ends, under which the appropriate distribution and carry-over moments are written.—I. E. MORRIS, Consulting Engineer, Atlanta.

Field and Office Comment

Vertical Curves by Slide Rule

Sir: The method given by Samuel Lechner for computing vertical curve corrections with a slide rule (*ENR* Aug. 8, 1946, vol. p. 187) is doubtless simpler than longhand or machine calculation. However, we have used a similar, simpler method since long before calculating machines came into general use.

By our method, the slide of the rule is set so that one-half the length of the curve on the "C" scale coincides with the value of the middle ordinate on the "A" scale. Corrections for any distance ahead of the beginning of the vertical curve, or back from its end, appear on the "A" scale opposite the distances on the "C" scale.

The accuracy of this method is the same as for Mr. Lechner's method, and multiplication of the middle ordinate by 4 is not necessary. Also, at least one slide rule manipulation is eliminated.—ROBERT T. EWEN, *Federal Works Agency, Public Roads Administration, Portland, Ore.*

Book Notes and Reviews

The month's addition to the engineer's reading and reference list

Law for Engineers

THE ENGINEER AT LAW—By C. B. and J. R. McCullough. Two volumes, 450 pp. ea. Iowa State College Press, Ames, Iowa. $3 each volume.

Written by the late assistant chief engineer of the Oregon Highway Department and his lawyer son, this treatise features the parts of the law that are applicable to engineers, contractors and the business of building. Following an interesting introduction on development of the law, the basic principles of contracts, torts, equity, real property, employment law and the like are covered in readable but authoritative sections. Included are full chapters on specifications, administrative law and the engineer in court and trial work.

As might be expected, much of the subject matter is devoted to the problems of engineers in public agencies, but since so many engineers and contracting organizations either work for or have contact with public agencies an understanding of this viewpoint is of considerable value.

The authors, as is usual with writers on law for engineers, disclaim any intention of making the engineer his own lawyer. They do emphasize the necessity for planning and prosecuting engineering work to satisfy the technical requirements of the law as well as its equitable demands and thus avoid litigation.

The two volumes appear to be written so that they are usable both as a text for the study of engineering law and for use by practicing engineers and contractors.

Modular Design

A62 GUIDE FOR MODULAR COORDINATION—By Myron W. Adams and Prentice Bradley. 271 pp. 292+ illustrations. Modular Service Assn., 110 Arlington St., Boston. $10.

Dimensional coordination of the materials of construction has long been aimed at as a major means of achieving economy and simplification. In recent years, considerable progress has been made through an industry-wide approach to the problem through Project A62 of the American Standards Association, which was sponsored jointly by the American Institute of Architects and the Producers' Council, with a secretarial and technical staff provided by the Modular Service Association. A basic module, or unit, of 4 in. has been agreed upon (*ENR* Oct. 18, 1945, vol. p. 508). Most producers of masonry products have already adopted modular coordinated sizes; glass block dimensions already conform; and solid-section steel windows, double-hung steel windows, and double-hung wood windows are now being manufactured against stock in modular sizes only. In addition, a large variety of products, such as wood framing, wallboards and insulation, have been made in standard sizes that are correct for modular coordination.

To assist architects and engineers in applying this principle to building plans and details, this Guide for Modular Coordination has been prepared. Profusely illustrated, it is arranged as a source of general information on the subject and as a convenient reference for particular products.

Depression Wage Rates

THE PUBLIC WORKS WAGE RATE AND SOME OF ITS ECONOMIC EFFECTS—By Viola Wycoff. 313 pp. Columbia University Press, Morningside Heights, New York. $3.50.

This careful analysis of the effects of the wages policies—or better the lack of wage policies—in the Works Progress Administration, Public Works Administration and other federal agencies during the early Thirties should be of great help in avoiding similar confusion in the future should this country find itself in another business depression. Those who tried to set wage rates for the FERA, CWA, WPA and PWA lacked precedent and so can be excused for having made errors; but as Miss Wycoff points out, changes that were made after the first hurried decisions appear to have been made as the result of the activities of pressure groups rather than for sound economic reasons. Few who are familiar with what happened in those years will not be surprised to find in this book a clear indication that loose social thinking rather than sound economics played a large part in determining pay rates on the federally financed work.

Readers of this journal will find special interest in the chapter on "PWA and Building Trades," in which the effect of PWA rates on rates for private work is discussed.

Marine Salvage

UNDER THE RED SEA SUN—By Commander Edward Ellsberg. 500 pp. Dodd, Mead & Co., 432 Fourth Ave., New York. $3.50.

Concerned with one of the tough behind-the-lines battles of the war—the salvaging of the ships, drydocks and floating cranes scuttled by the Italians in the Red Sea naval base at Massawa in Eritrea—this book unfolds an account of what is essentially a construction operation. The author, who was assigned to the job as salvage expert under the Corps of Engineers whose civilian contractor's salvage forces he directed, will be remembered for his prewar marine salvaging exploits including the raising of the submarines S-51 and S-4 about which he has also written books.

The reader interested only in the salvaging operations can skip the first 112 pages, after he has read a few short introductory chapters, for here is just another account of the vicissitudes of wartime travel—which Commander Ellsberg tells no better and no worse than dozens of others before him. But from his arrival in Massawa in early 1942 until he left nine months later for a job in the wreck-choked harbor of Oran, North Africa, Ellsberg did things and writes about them in a slam-bang way that should appeal to construction men.

Massawa harbor offered the greatest mass of wrecks in the world, including Pearl Harbor, he says, adding (probably without complete acceptance by the men who built the port at Khorramshahr, Persia) that heat, humidity and mosquitoes made it the worst place in the world to live and work. With this setup and under these conditions, with few men and fewer tools, he repaired the naval

shops; secured from another port a small floating drydock in which he repaired three British cruisers and dozens of merchant vessels; raised a big Italian floating drydock, whose floor was punctured with blasted holes, by sealing her walls and pumping them full of compressed air; raised ships by sealing their shattered hulls with timber, concrete and canvas and then pumping them dry; and raised a sunken floating crane with four large cylindrical gasoline tanks converted to pontoons.

The reader will have to wade through a good deal of pointing with pride at Ellsberg, but will have to admit the accomplishments and admire them, as well as the author's devotion to duty, and his courage (he dived three times into the sunken drydock to bring out three of his trapped men).

The Massawa job was not only a battle against natural forces, but a continual fight with people. As the author tells it, he was always right; as some others have told it, he was sometimes wrong and always difficult to deal with. In the book he pulls no punches in berating the administrative forces of the American contractor and in describing the failures of a British civilian contractor to salvage ships and a floating crane in the commercial harbor adjacent to the naval base. Paradoxically, despite the author's antipathy to contractors, he would have made a top notch construction superintendent himself, his qualities of self assurance, field know-how, leadership, and personal courage, and his to-hell-with-the-front-office attitude, being the very ones that contractors seek. In addition, Ellsberg has the ability to write, and in "Under the Red Sea Sun" he has turned out a rousing if sometimes intemperate story of American accomplishment in the early days of the war.

New French Dictionary

ENGLISH-FRENCH AND FRENCH-ENGLISH TECHNICAL DICTIONARY—By Francis Cusset. 590 pp. Chemical Publishing Co., Brooklyn, N. Y. $5.

Prepared by a French mining engineer, this handy little dictionary will be of great help to engineers who wish to keep in touch with developments in France through the medium of French technical journals and books but who find most non-technical dictionaries deficient in engineering terms. A section in the back of the book entitled "Compléments" will be found especially useful as it is given over to definitions of engineering terms and phrases.

Miscellaneous Notes on Booklets and Reprints

SEWAGE SLUDGE AS A FERTILIZER is evaluated in a 120-page manual of practice issued by the Federation of Sewage Works Associations. The book details methods of processing and applying sludge, hygienic aspects and economic considerations. Copies are $1.25 and may be obtained from the association's headquarters, 325 Illinois Bldg., Champaign, Ill.

APPRENTICESHIP POSSIBILITIES for construction workers are outlined in a reprint "Skilled Help for Construction" available from the Apprentice-Training Service, U. S. Department of Labor, Washington 25, D. C. Prepared jointly by the contractor and labor representative of the Atlanta, Ga. Apprenticeship Committee, the article, appearing originally in *ENR* Oct. 3, 1946, vol. p. 427, includes information on work processes, wages, allowances and record keeping.

New Engineering Books

THE PUBLIC WAGE RATE AND SOME OF ITS ECONOMIC EFFECTS—By Vioal Wyckoff. 313 pp. The Columbia University Press, Morningside Heights, New York. $3.50.

UNDER THE RED SEA SUN—By Commander Edward Ellsberg. 500 pp. Dodd, Mead & Co., 432 Fourth Avenue, New York. $3.50.

GERMAN-ENGLISH SCIENCE DICTIONARY—2nd Edition—By Louis DeVries. 558 pp. McGraw-Hill Book Co., New York 18, and London. $4.50.

THE MAGIC OF NUMBERS—Eric Temple Bell. 418 pp. McGraw-Hill Book Co., New York 18, and London. $3.50.

ADVANCED MECHANICS OF MATERIALS—By Glenn Murphy. 307 pp. McGraw-Hill Book Co., New York and London. $4.

ELECTRICAL ENGINEERING—By Fred H. Pumphrey. 369 pp. Prentice-Tall Inc., 70 Fifth Ave., New York. $5.35.

TRIGONOMETRY REFRESHER—By A. Albert Klaf. 629 pp. McGraw-Hill Book Co., New York 18, and London. $5.

HEATING AND AIR CONDITIONING—Sixth Edition—By J. R. Allen, J. H. Walker, J. W. James, 667 pp. McGraw-Hill Book Co., New York 18, and London. $5.50.

A62 GUIDE FOR MODULAR COORDINATION—By Myron W. Adams and Prentice Bradley. 271 pp. 292 illustrations. Modular Service Assn., 100 Arlington St., Boston 16, Mass. $10.

HIGHWAY RESEARCH BOARD—PROCEEDINGS 25TH ANNUAL MEETING—486 pp. Highway Research Board, 2102 Constitution Ave., Washington 25, D. C.

Reports and Pamphlets

A YEAR BOOK OF RAILROAD INFORMATION—1946 Edition—Eastern Railroad Presidents Conference Committee on Public Relations, 143 Liberty Street, New York 6, N. Y.

THE PRACTICAL WAY TO HANDLE GRIEVANCES—Labor Relations Institute, 1776 Broadway, New York 19, N. Y. $2.25.

BARRETT ROAD BOOK—Seventh Edition—The Barrett Division, Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y.

MANPOWER AND MATERIAL REQUIREMENTS FOR A HOUSING PROGRAM IN CANADA—Department of Reconstruction and Supply, Ottawa, Canada. 50c.

SOIL TESTS FOR MILITARY CONSTRUCTION—By Major George E. Bertram. Technical Bulletin No. 107. American Road Builders Association, 1319 F St. Washington 4, D. C. 50c to non-members.

EVALUATING URBAN TRAFFIC PROBLEMS BY NEW TECHNIQUES — ARTERIAL STREET PLANNING FOR URBAN AREA PROBLEMS—PROPERTY ASSESSMENT FOR STREET IMPROVEMENTS—Bulletin No. 106. American Road Builders' Assoc.

COMMITTEE PANEL DISCUSSIONS ON PROBLEMS RELATING TO MUNICIPAL STREET ADMINISTRATION — Bulletin No. 113. American Road Builders' Assoc.

SOUTHEASTERN ASSOCIATION OF STATE HIGHWAY OFFICIALS — Proceedings — September 1946. H. J. Neale, Secretary-Treasurer, Department of Highways, Richmond, Va.

CITY FINANCES—1944—U. S. Department of Commerce. Obtainable from Superintendent of Documents, Washington 25, D. C. 70c.

CONDENSATION IN WALL SPECIMENS — Report BMS 106, National Bureau of Standards. Superintendent of Documents, Washington, D. C. 10c.

HOUSING FOR YOUR TOWN—Regional Plan Association, 205 East 42 St., New York 17, N. Y.

METAL LATH SPECIFICATIONS FOR PLASTERING AND CONCRETE STUCCO—Metal Lath Manufacturers Association, Engineers Building, Cleveland 14, Ohio.

TRAFFIC STUDY—Future Springfield, Inc., 1383 Main Street, Springfield 3, Mass.

CURVE REALIGNMENT ON THE EAST INDIAN RAILWAY—By J. M. Fenton. Technical Paper No. 316. Manager of Publications, Delhi, India. 4s. 3d.

(*Continued on p.* 174)

THE LABOR CRISIS

..."Absolute power corrupts absolutely"

THE NEW CONGRESS is going to overhaul the federal laws governing organized labor. If the election returns left any doubt about that, John L. Lewis has removed it by torturing the nation with its second soft coal strike in six months.

If, however, the overhauling is to get at the roots of our labor troubles, it must go further and deeper than most of the proposals would go. Indeed, it must not stop until it has dealt decisively with that most basic cause of devastating trouble – the entrenched monopolistic power of enormous international unions, now concentrated in a handful of union leaders. Industry-wide collective bargaining is one outgrowth of this power.

"Power tends to corrupt, and absolute power corrupts absolutely." That great truth, phrased by the historian Acton, is as true of labor leaders as it is of business leaders, princes or potentates. It is also true that John L. Lewis and some of his fellow labor leaders now wield what approaches absolute power in their respective domains. Failure to recognize these facts and act on them can make a tragic mockery of the present opportunity to restore good sense and good order to our labor relations and our national life.

To realize this opportunity the labor monopoly must be made a major target.

In the minds of many people, particularly in the business community, the root cause of our labor troubles is to be found in the National Labor Relations Act, commonly called the Wagner Act. They feel that if they could get rid of the one-sided handling of a number of key labor problems provided by that act and its administrators, we would have the legislative part of the problem of creating good labor relations pretty well solved.

To be sure, there is occasion, long overdue, to balance up the lopsided treatment of labor relations by the Wagner Act and those who apply it. It has been so interpreted and applied as to deny free speech to employers. On occasion it has extended the special protection of the federal government to workers striking to force employers to break the law. It has done the same for workers striking to force the federal government to change its policy the way the strikers want it changed.

The Wagner Act has required employers to bargain with unions, but imposed no companion obligation upon unions to bargain with employers. It has given protection to workers who have broken their agreement by striking. It has been applied so as to break orderly lines of management by encouraging and giving special protection to union organization of foremen who, to do their work efficiently, must represent management. Abuses such as these should be cleaned up, and soon.

Monopoly is the Target

But if perfection were attained in eliminating all of the abuses stemming from the Wagner Act, numerous and grievous as they are, the basic problem of establishing the legislative foundations of sane and safe labor relations in the United States would by no means be solved. John L. Lewis and his fellow labor dictators would, no doubt, be annoyed, but their power would not be seriously impaired. *That power is derived from monopoly control of labor.* Just as in the case with any other kind of monopoly power, it will only be made subservient to the public interest by attacking it at the source and smashing it.

The way to do that is to apply the anti-monopoly laws to monopolies in the field of labor just as they are applied to business and industrial monopolies. At the same time more vitality should be pumped into these laws all along the line.

When our basic anti-monopoly law, the Sherman Antitrust Act, was passed in 1890, it was designed to apply to economic monopolies of all kinds, and was so held by the courts. Organized labor sought exemption from this law, largely on the ground that its bargaining power was weak, as compared with that of industrial corporations. In recent decisions, a majority of the United States Supreme Court

justices have held that, when combined with the Clayton Act of 1914, the Norris-La Guardia Act of 1932 gives organized labor virtually complete exemption from the antitrust laws.

In the meantime, the relative weakness in bargaining power which was made the occasion for exempting organized labor from the antitrust laws has become a myth. In soft coal, John L. Lewis is the monopolist. Through his United Mine Workers he controls about 90% of the miners. No one of the thousand or more highly competitive companies engaged in soft coal mining controls more than about 5% of the output.

In steel the monopoly control is that of Philip Murray's United Steel Workers whose organization represents well over 80% of the production workers in that industry. United States Steel, the corporate "giant," controls only about one-third of the steel making capacity. In automobiles the United Automobile Workers represent about 90% of the production workers. A year ago the union's officers flaunted their monopoly power by announcing plans to pick off one automobile manufacturer after another by a series of centrally controlled strikes.

Industry-Wide Bargaining

Confronted by the rise of government-fostered monopoly power in the hands of organized labor, employers in some industries have sought to match it by joining together for collective bargaining on a more or less industry-wide basis. In other industries, notably steel, the federal government, through the War Labor Board, took the lead in forcing a pattern of industry-wide bargaining. Bedevilled by a myriad of cases, the Board thus sought to settle scores of them in the steel industry by one action.

It is easy to understand how an employer, confronted by an industry-wide monopoly of labor, would be tempted to join with his fellow employers in an industry-wide bargaining group. In that way he might see a chance to establish something like equality in bargaining power.

However, if the employers' bargaining group were as effective as the union in creating a monopoly set-up, it would merely confront one monopoly with another. That, in turn, would heighten the chances of having either a devastating head-on collision as a result of failure to agree, or having the two monopolies reach an agreement at the expense of the consuming public.

Actually, however, the chances that employers can create an industry-wide bargaining group as tight as that created on the side of labor by union organization are virtually zero. For if a group of employers were to agree to shut down in unison or take other united steps to balance the bargaining power created by the threat of a monopolistic union to strike, they would unquestionably find themselves on the receiving end of an indictment for violation of the federal antitrust laws.

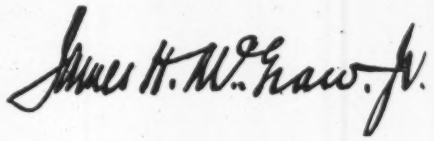
To Break the Monopoly

Thus, both from the point of view of the public and the point of view of the employer, industry-wide bargaining is no effective offset to the monopoly power created by industry-wide unions.

The only way to cope with this monopoly power is to subject it to the anti-monopoly laws in the same way business and industrial management are subjected. In the process industry-wide labor monopolies would be cut down to safe size, possibly by limiting the percentage of workers in any industry who are permitted to belong to a single labor organization.

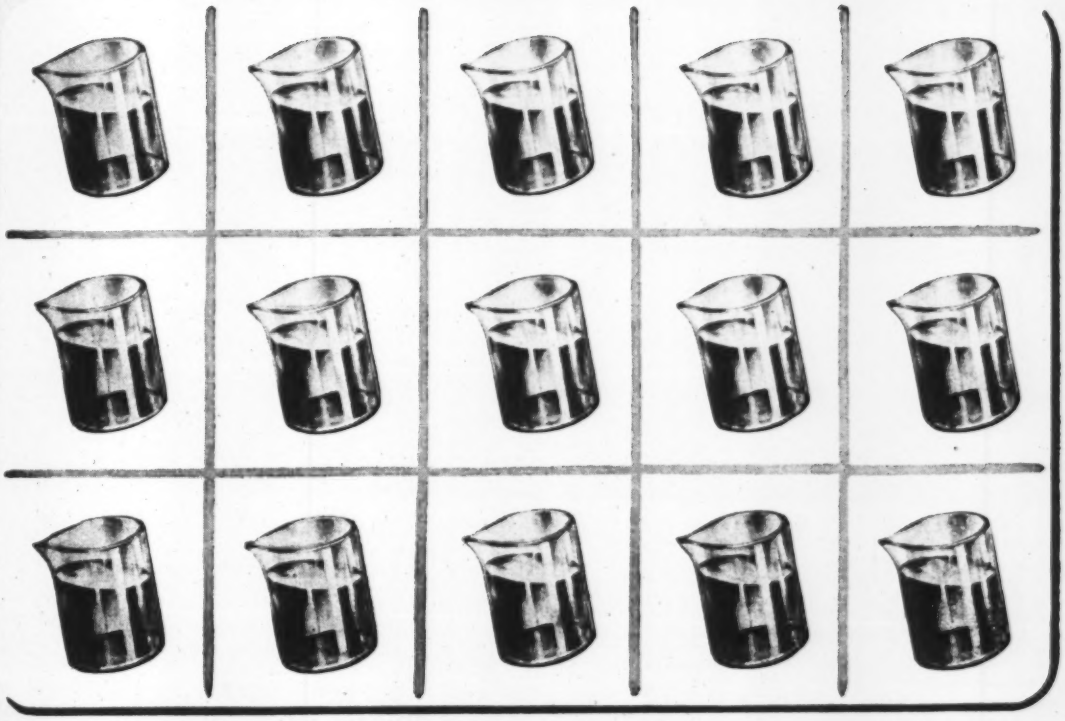
Also application of anti-monopoly laws would clean out local pockets of labor monopoly which block the way of industrial progress. As matters stand, the freedom of unions from control by the antitrust laws permits organized workers in one city to refuse to install equipment shipped in from another city, thus establishing private tariff walls. It also permits organized workers to refuse to install or work on materials made by other workers whose union affiliation, or lack of it, they do not like.

If the anti-monopoly laws were applied to organized labor, boycotts of this sort would be outlawed. In the aggregate they now take a tremendous toll for no legitimate purpose. But primarily John L. Lewis and a handful of his fellow labor dictators might be cut down to a size that can be safely accommodated by the American democracy. If that is not done, the last great opportunity to give industrial and political democracy a chance to work, in its last great stronghold, will be lost. From such a tragic turn of events no one would lose more than the American worker.



President McGraw-Hill Publishing Company, Inc.

UNIFORMITY...



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Laboratory analyses of Shell "DIESELINE*" reveal its month-after-month, year-after-year uniformity. That is why it enables Diesel operators to tune an engine's fuel injection system to that fine point which brings maximum economy . . . and hold it there!

Unvarying quality in engine-testing fuels is of utmost importance to Diesel manufacturers . . . and it is significant that many prominent builders have standardized on Shell "DIESELINE"—not just for the past year or two, but for ten, and in the case of one of the leading engine makers, for *twelve consecutive years!*

Try this modern quality fuel in your engines for a month or two. Keep records and compare with the results you've been getting. You will be impressed by the top-notch, *consistent* performance you get from Shell "DIESELINE."

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SHELL

SHELL "DIESELINE"

MATERIALS AND LABOR PRICES

Market quotations on construction materials and wage rates reported monthly by ENR correspondents

There have been scattered increases since removal of OPA price controls. More widespread increases are expected next month. LUMBER rose $3.886 per M ft. B.M., according to the ENR 20-cities average. Birmingham showed the greatest rise with an increase of $34.50 for 2x4 Southern Pine. Other increases were $8 in Detroit, $4 in Pittsburgh, and $1.50 in Baltimore. 2x4 Douglas Fir rose $10 in San Francisco, $3.30 in Pittsburgh, and $1.50 in Baltimore. RED LEAD rose $3.50 in all cities, and WHITE LEAD rose $8.

ALUMINUM PAINT rose $.30 per gal. in Birmingham, $.66 in Denver, $.40 in Los Angeles, and $.09 in Seattle. ASPHALT FELT ROOFING rose $.07 per 100 lb. in Birmingham, $.15 in Los Angeles, $.1997 in New York, and $.07 in Seattle. LIME, hydrated finishing, rose $3.20 per ton in Minneapolis, $3.60 in New York, $1.00 in San Francisco, and $7.95 in Seattle. WAGE RATES remained fairly constant, the skilled average increasing only .008 per hour, and the common average, .007. In Cleveland, however, all construction wages increased $.125.

CEMENT, AGGREGATE, READY-MIXED CONCRETE—F. O. B. CITY

	PORTLAND CEMENT — Per bbl C/L lots incl 40c per bbl. for bags, cash dis. not deducted			SAND AND GRAVEL — Per ton, carload lots			CRUSHED STONE Per ton, carload lots		CRUSHED SLAG Per ton, carload lots, f.o.b. plant		CONCRETE BLOCK 8x8x16-in.; truckload del.; per block		READY MIXED CONCRETE 1:2:4, over 1 cu. yd. del.
	Cloth	Paper	Bulk	Gravel 1½ in.	Gravel ¾ in.	Sand	1½ in.	¾ in.	1½ in.	¾ in.	Sand-grav	Lt.wgt.Agg.	
Atlanta	$2.77	$2.52	$2.43	$1.79	$1.89	$1.65	$1.79	$1.89	$1.59	$1.69	$0.17	....	$9.00
Baltimore	2.70*r*	2.45*a*	2.20*a*	2.05‡	2.05‡	1.55‡	2.00‡	2.00‡	2.00‡	2.00‡	.145	$0.145*w*	8.00
Birmingham	2.70	2.45	....	2.00	2.00	1.59	2.50	2.50	.90	1.15	.1425	....	6.90
Boston	3.70*bqq*	2.85*b*	2.60	1.50‡	1.50‡	1.40‡	1.25	1.35	....	....	.13	.155*w*	7.90*m*
Chicago	3.60	2.75	2.56	2.45‡*d*	2.45‡*d*	2.50‡*d*	2.45‡*d*	2.45‡*d*	1.75‡	1.75‡	.195	.195*x*	....
Cincinnati	2.59	2.34	2.14	1.20	1.20	1.10	1.80	1.80	....	....	.15	.18*w*	7.45
Cleveland	3.28	2.43	2.18	1.75*i*	1.75*i*	1.40/2.05*i*	1.50*i*	1.50*i*	1.23	1.23	.19	.19	8.75
Dallas	2.51	2.26	2.06	1.80	1.80	1.45	1.72	1.82	....	....	.0875*p*	....	8.20
Denver	3.74	2.94	2.69	1.20	1.45	.90	1.65	1.75	....	....	....	.1625*w*	9.00
Detroit	3.28	2.43	2.23	2.65	2.65	2.35	2.25	2.25	2.00‡	2.00‡	.16	.17*w*	7.85
Kansas City	2.80	2.60	....	2.00	....	1.40	2.00	2.00	....	....	.16	.16*wy*	8.50*n*
Los Angeles	3.30*r*	2.70*r*	....	1.44	1.44	1.33	1.44*f*	1.44*f*	1.44*f*	1.44*f*	.125*bb*	.1*bb*	8.72*m*
Minneapolis	4.10*dd*‡*gg*	3.25*dd*‡	....	1.00*h*	1.00*h*	.25*h*	1.00*h*	1.00*h*	....	....	.183*ff*	....	8.45*kk*
Montreal	....	1.95*r*	1.80*r*	1.65‡*s*	1.65‡*s*	1.60*t*	.80*ct*	.90*ct*	....	....	.1924	....	7.00*s*
New Orleans	2.41	2.16	1.92	1.67	1.65	1.21	....	....	.90	1.15	.23	....	9.25
New York	4.16‡*gg*	3.16‡	....	1.80*deu*	1.80*deu*	1.15*eee*	1.80*ds*	1.80*ds*	....	....	.16*ii*	.18*wcii*	8.95*kq*
Philadelphia	2.75	2.50‡	2.30‡	1.55‡	1.65‡	1.20‡	1.90‡	1.95‡	1.25	1.25	.155	.155*w*	8.55
Pittsburgh	2.80	2.55	2.35	1.85‡	1.85‡	2.15‡	2.35‡	2.35‡	1.80	1.80	.23*z*	.23*z*	9.35
St. Louis	3.76*ohh*	2.88*o*	....	1.81‡*o*	1.81‡*o*	1.71/1.81‡*o*	1.28/1.95	1.28/1.95	.90*q*	1.15*q*	.175	.20*yo*	8.70
San Francisco	2.97	2.37	2.07	1.46	1.46	1.56	1.56	....	....	....	....	.23*y*	8.55
Seattle	....	2.99*o*	....	2.35*d*‡	2.35*d*‡	2.35*d*‡	2.85‡*od*	2.85‡*od*	....	....	.17	....	8.25

‡ Delivered. *a* 10c. allowed for each returnable bag. *b* 10c. per bbl. off for cash. *c* F.o.b. quarry. *d* Per cu. yd. *e* Barge lots alongside docks. *f* Crushed granite. *g* F.o.b. Granite City, Ill. *h* F.o.b. plant. *i* Within three miles of Public Square. *j* 5% discount for cash. *k* Discount of 2 percent for cash in 10 days. *l* 2000 lb. concrete. *m* 50c. off for cash. *n* 25 c.y. or more. *o* 2% off for cash. *p* 5½ x 8 x 12 in. *q* 5 cu. yds. or more. *r* 10c. per bbl. off cash 20 days. *s* 8% sales tax included. *t* 8% sales tax not included. *u* In outlying New York districts, price is $1.89. *v* 20c. per bbl. discount; 80c. per bbl. for bags. *w* Cinder. *x* Waylite. *y* Haydite. *z* Celocrete. *aa* Pumice. *bb* 6 x 8 x 12 in. *cc* Also 8 x 18 in. *dd* Prices quoted are LCL. Carload lots not available. *ee* In outlying New York districts, price is $1.22. *ff* 8 x 8 x 18 in. *gg* $1.00 per bbl. refund for return of bags. *hh* $.20 per bbl. refund for return of bags. *ii* Yard price. *kk* 2500 lb. compression strength.

CASH DISCOUNTS CEMENT to Contractors: truck delivery, 2% for cash on 10th of month; on carload deliveries, no trucking, same as dealer cash discount. 10c. per bbl. for payment within 15 days of date of invoice. Subject discount 10c. per bbl. 20 days in Montreal.

CURRENT MAXIMUM PRICE BASES AT CEMENT MILL

Charge for bags not included. For cloth bags, add $1.05c. per bbl.; 25c. refund allowed for each returnable bag; for paper bags add 20c. per bbl., not refundable.

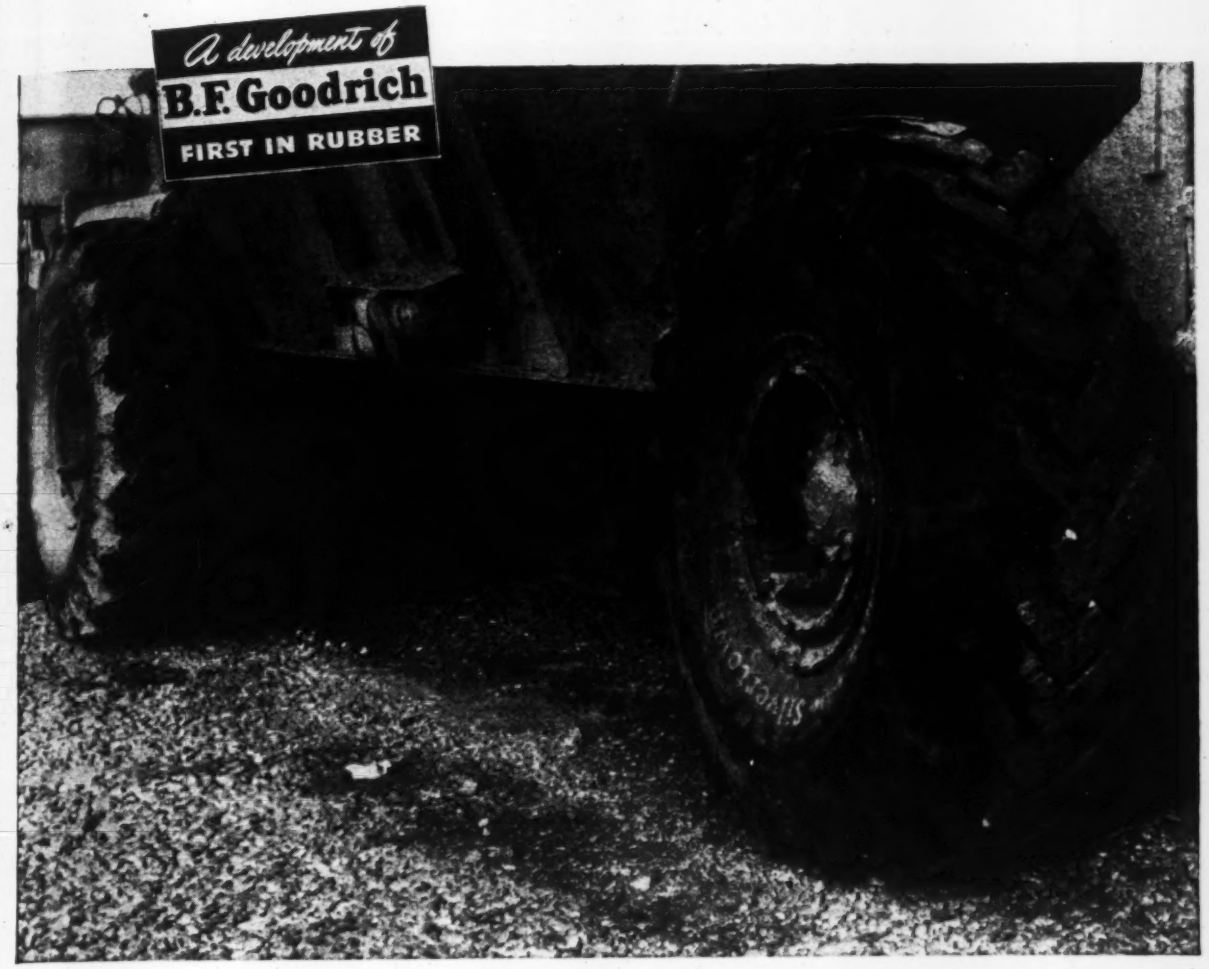
	Bagged	Bulk		Bagged	Bulk		Bagged	Bulk
Buffington, Ind.	$1.90	$1.85	Ironton, Ohio	$1.80*	$1.75*	Universal, Pa.	$1.85	$1.90
Hannibal, Mo.	1.90	1.85	Northampton, Pa.	1.75	1.70	Waco, Tex. (Plus 9c. tax in Tex.)	1.75	1.80
Independence, Kans.	1.90	1.85	Richard City, Tenn	2.05*a*	1.95	Montreal City (Discount 10c. per bbl. 20 days)	1.68	1.68
			Steelton, Minn.	2.00	1.95			

* Destination price base effective Sept. 17, 1945
a For cloth bags, add $1.00.

PAVING BRICK, BLOCK, ASPHALT, ROAD OILS—F. O. B. CITY

	PAVING BRICK AND BLOCK — Granite per M lots of 50,000 4x4x8 in	Brick per M 3x4x8½ in. carload lots	Wood per sq. yd. 3½ in. 16-lb. treat	PAVING ASPHALT Per ton, less than 80 penetration — Tank car	Drums	ASPHALT BINDERS—FLUXES Per gal., 80–300 penetration — Tank car	Drums	CUTBACK ASPHALT Per ton — Tank car	Drums	ROAD OIL Per gal — Tank car	ASPHALT EMULSION (Quick-breaking) Per gal — Tank car	Drums
Atlanta	$73.00	$35.00	$2.25	$14.00	.....	$0.074	.....	$0.0806*h*	.....	$0.0781	$0.0806	.....
Baltimore	150.00‡	52.70	85.00*m*	15.00*r*	21.00*r*	.06*r*	0.09*r*	13.00*r*	23.00*r*	.06*r*	.07*r*	.14*r*
Birmingham	.....	32.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Boston	85.00	59.00	3.75	16.00	25.00	.0675	.12	18.00	31.00	.0675	.0875	.15
Chicago	150.00‡	65.00/68.00*e*‡	2.85/4.00*d*	15.00/16.00	23.50	14.15/15.00*g*	22.65*g*	.0625/.0675*h*	.155/.16*h*	.05/.0575	.0925/.1025‡	.135/.155‡
Cincinnati	125.00	66.90	.....	19.40	.....	.10	.....	22.60	.....	.09	.10	.....
Cleveland	127.50	39.00	3.87	17.00	19.00	.085	.085	.10*h*	.11	.08	.....	.....
Dallas	.....	40.00	.....	15.36	22.70	.0618	.12	17.95	28.00	.06	.0725	.135
Denver	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Detroit	.....	75.00*t*	.....	17.60*f*	26.56*f*	.0734	.128	.0718*h*	.119*h*	.067	.0974	.135
Kansas City	.....	45.00	.....	15.00*u*	20.60*u*	16.60*g*	.....	.07*h*	.0675*hu*	.....	.11	.15*u*
Los Angeles	.....	50.00	.....	9.00*b*	23.00*b*	9.50*bg*	24.00*bg*	9.50*bg*	.....	.03*b*	.08*b*	.16*b*
Minneapolis	.....	.....	2.39*d*	.....	.....	.....	.....	.....	.....	.....	.....	.....
Montreal	70.00	.....	.....	16.60*k*	24.25*k*	.1035*k*	.111*k*	.115*hk*	.135*hk*	.08*k*	.135*k*	.188*k*
New Orleans	.....	.....	.....	13.00*a*	.....*s*	12.00*g*	.....*s*	5.75	.....*s*	.05	.....	.....
New York	.....	.....	2.75*n*	20.68	30.24*s*	.0834*t*	32.11*g*	.0857*h*	.1376*h*	.0807	.0822	.1328
Philadelphia	150.00	62.00	4.06	16.00	.....	15.00	.....	.0675*h*	.....	.....	14.00*gr*	.....
Pittsburgh	135.00	39.75	3.90	19.00	26.00	.095	.17	22.00	33.00	.075	.085	.14
St. Louis	.....	42.00	.....	14.80	19.80	13.80*g*	18.80*g*	.0587*h*	.1362*h*	.483	.07	.1215
San Francisco	.....	47.75*c*	.....	11.75	21.00	11.75*g*	.....	13.75	.....	.....	.0525	.1125
Seattle	.....	.....	.....	11.75*i*	22.75*i*	9.50	.....	11.75*i*	14.75	10.90*i*	.0525*i*	.0625*i*

‡ Delivered. *a* F.o.b. Baton Rouge. *b* F.o.b. Refinery. *c* 2½ x 8½ x 4 in. on request only. *m* Per thousand. *n* 2 in., treatment 6 lb. *r* February 1943 prices, none later available. *s* Drums not available. *t* Very scarce. Truck deliveries in small quantities. *a* 2-in interior block, 6-lb. treatment. *c* 3½ x 4 x 8½. *f* Mexican. *g* Per ton. *h* Per gallon. *i* F.o.b. Martinez. *j* 3 x 3½ x 8½ in. *k* Tax included. *l* Quoted



Built-in bruise resistance adds longer life to these super-traction tires

HERE'S a story that may help you cut down tire bruises and blow-outs. It can also help you with other tire problems — the kind that come from equipment miring down in soft dirt, sand, etc.

It began when B. F. Goodrich engineers made special studies of those problems. They wanted to find new ways to protect big, costly tires against cuts and impacts from sharp rocks — the kind of shocking impacts that cause bruises, ply separation, and blow-outs.

They found the answer when they developed a new construction principle — the Shock Shield — built it into a new kind of tire called the Super Traction (shown above).

This tire has an enlarged tread contact area which gives maximum flotation. The tire stays on top instead of digging in. Loads practically *float* over soft dirt, yet the self-cleaning tread gives extra traction.

The job of protecting against impact bruises is done by the B. F. Goodrich Shock Shield. This shield is a set of four breakers — layers of rubber-coated rayon cords — built in between the tread and the plies. The breakers are in pairs, with the cords in each pair running parallel to each other, but with each pair running in opposite directions to give balanced strength. The breakers are cushioned with thick layers of shock-resistant rubber.

Under impact, the cords in the breakers stretch together, *not* across each other, and return to their original position. The blow is distributed and absorbed by the rubber cushions. Any shock passed on to the cord body is greatly reduced.

Contractors using the Super Traction and other B. F. Goodrich tires built this way report substantial savings in operating costs. Tire life is longer — sometimes nearly tripled. Traction is better. Repair bills are lower. Delays are reduced. Find out how these tires can make similar savings for *you*. See the B. F. Goodrich dealer, or write us direct. *The B.F. Goodrich Company, Akron, Ohio.*

Truck Tires BY

B.F. Goodrich

IRON AND STEEL PRODUCTS—BASE MILL PRICES

	STRUCT. SHAPES-PLATE	REINF. BARS ¼-in. billet *b*	RIVETS ½-in. structural	WIRE NAILS Base	SHEET PILING Base	STEEL RAILS Per Net Ton Standard	Light	Re-rolled	TRACK SUPPLIES Angle Bars	Std Spikes *c*	Tie Plates *c*	Track Bolts
Birmingham	$2.35	$2.35	$4.75	$3.75	....	$43.40	$49.18	Not	$2.85	$3.65	$2.55	$6.50
Chicago	2.35	2.35	4.75	3.75	$2.65	43.40	49.18	avail-	2.85	3.65	2.55	6.50
Pittsburgh	2.35	2.35	4.75	3.75	2.65	43.40	49.18	able	2.85	3.65	2.55	6.50
Buffalo	2.35	2.35	....	....	2.65	.....	.....	.....	....	....	2.55	....
Cleveland	....	2.35	4.75	3.75	....	.....	.....	.....	....	....	....	....
Youngstown	....	2.35	....	....	....	.....	.....	.....	....	3.65	....	....
Detroit	....	2.485‡	....	....	....	.....	.....	.....	....	....	....	....
Gulf ports	2.70*a*	2.735*a*	....	....	2.85*a*	.....	.....	.....	....	....	....	....
Pacific ports	3.00*a*	2.785*a*	....	4.25*a*	3.20*a*	.....	.....	.....	....	3.90	2.70	....

‡ Delivered. *a* F.o.b. cars dock. *b* Rail steel same as billet prices. *c* Other basing points include Portsmouth, O., Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., and Pacific coast ports, on tie plates alone. Steelton, Pa., on spikes alone, Lebanon, Pa., Richmond, Va. *d* Add switching charge $18 per cl.

IRON AND STEEL PRODUCTS—F. O. B. WAREHOUSE, PER 100 LBS., BASE PRICE

	STRUCTURAL SHAPES Per 100 lb. base price	REINFORCING BARS*g* Per 100 lb., ¾ in., base price 15 tons or over *b* New billet	Rail steel	Add Switch	$/cwt. for Del.	EXPANDED METAL LATH Per 100 sq. yd., carload lots Std. diamond mesh, 3.4 lb	Std. ribbed 3.4 lb.	WELDED FABRIC REINFORCING Per 100 sq. ft., carload lots 4x16 in., No 5 & 10 wires	4x12 in., No. 8 & 12 wires	6x6 in. No. 6 & 6 wires Per 100 s. f.	SHEET PILING Per 100 lb base price
Atlanta	$4.05‡	$4.12‡	$4.12‡	$.025	$.10	$23.16	$25.30	$1.93	$1.45	$2.05	$3.35
Baltimore	3.909	3.344	....	....	.10	24.50	26.50	1.81	1.37	1.93	3.25
Birmingham	....	....	....	....	.10	19.00	21.00	1.91	1.44	2.03	....
Boston	4.162‡	4.194‡	2.97*c*	$20 C.L.	.10	18.50	20.50	1.87	1.41	1.98	3.02
Chicago	2.35*a*	2.35*a*	2.35*a*	.03	.05	22.50‡	24.50	1.78	1.35	1.89	2.65
Cincinnati	3.983	2.90*cd*	2.90*cd*	....	.10	....*n*	....*n*	1.80	1.36	1.89	....
Cleveland	3.838	4.00	3.98	.025	.10	20.50	24.50	1.77	1.35	1.88	....
Dallas	5.25	4.17	4.17	....	....	25.50	27.50	2.04	1.52	2.17	....
Denver	4.89	4.77*o*	....	....	....	37.00	41.00	2.08	1.55	2.21	....
Detroit	3.952‡	3.14‡	3.14‡	....	.10	38.00‡	41.00‡	1.79	1.36	1.90	2.95
Kansas City	4.44	2.75*cd*	2.75*cd*	.0	.05	29.50	31.50	1.89	1.43	2.01	3.08*36*
Los Angeles	4.45*f*	3.025	2.875	.03	.05	23.00	27.50	2.04	1.52	2.17	4.45
Minneapolis	4.142‡	2.99	2.99	.0	.10	25.00	27.00	1.91	1.44	2.03	3.06*d*
Montreal	3.95*i*	3.10*i*	3.00*i*	....	...	31.00*hi*	46.00*hi*	2.87	3.54*i*	2.96*im*	....
New Orleans	4.408‡	3.84	4.108	.05	.10	22.00	24.00	1.93	1.45	2.05	3.125
New York	4.008	2.96*c*	2.96*c*	....	.15	17.50	19.50	1.83	1.39	1.95	2.74
Philadelphia	3.937	3.899	....	....	....	20.50‡	22.50‡	1.82	1.38	1.93	2.97
Pittsburgh	2.35*a*	2.35*a*	2.35*a*	.025	.10	23.00	26.50	1.70	1.30	1.81	2.65
St Louis	3.401	2.96	2.96	.0	.05	29.00	35.00	1.80	1.37	1.92	....
San Francisco	4.40	3.025	2.875	.025	.10	28.00	31.50	2.04	1.52	2.17	3.335
Seattle	3.00*e*	3.00*e*	....	....	....	43.50	44.00	2.04	1.52	2.17	3.20*e*

‡ Delivered. *a* Mill prices. *b* 5–15 tons, add 15c. 1–5 tons, add 25c. Less than 1 ton, add 50c. *c* 20 tons or over Base. *d* Mill price plus freight. *e* F.o.b. dock. *f* Includes delivery in free delivery zone. *g* High scrap steel prices cut former 15c. differences between new billet and rail steel in many mills. *h* List price. *i* Plus Dominion and Province sales tax. *m* Per sq. yd. *n* Practically no carloads are available. Retail price delivered is $27.00 for std. diamond mesh and $29.00 for std. ribbed. *o* 20 tons and over.

PLUMBING, HEATING, WATER, SEWER AND DRAIN PIPE

	C. I. PIPE Per net ton f.o.b. 6 in. to 24 in. *a*	VITRIFIED SEWER PIPE Per foot, std. 8 in. s.s.	Delivered std. 12 in s.s.	ASTM 24 in.	C13–35 36 in.	CLAY DRAIN TILE Per 1,000 ft., carload lots, f.o.b. 6 in.	8 in.	CONCRETE SEWER PIPE Per ft., delivered; ASTM 12 in.	C 14–35 24 in.	WROUGHT STEEL PIPE (Full standard weight, f.o.b. destination *s*) 1 to 3 in., Butt Weld Black %	Galv. %	3½ to 6 in., Lap Weld Black %	Galv. %
Atlanta	$65.66	$0.43	$0.67	$3.39	....	$114.00	$140.00	$0.45	$2.00	58.5	47.5	56.0	44.5
Baltimore	70.20	.35	.60	2.70	$7.25	160.00	200.00	.85	2.25	62.1	51.1	59.6	48.1
Birmingham	61.00	.35	.63	2.736	....	200.00	350.00	.57	1.80	58.5	47.5	56.0	44.5
Boston	72.80	.392*m*	.756*m*	3.15*m*	7.995*m*	170.00‡*m*	265.00‡*m*	.53	2.04	66.0	49.6	58.1	46.6
Chicago	70.33	.49	.945	3.60	....	110.00‡	150.00‡	.65	2.25	64.0*t*	53.0*t*	60.5*t*	49.0*t*
Cincinnati	69.27	.327	.6345	3.735	10.04	98.70	151.60	.36	1.60	62.6	51.6	60.1	48.6
Cleveland	70.75	.226*m*	.513	2.15	5.535	138.50	216.60	.36	1.60	64.71	53.71	62.21	50.71
Dallas	72.43	.365	.657	2.664	6.00	108.00	130.00	.46	1.75	56.5	45.5	53.9	42.4
Denver	77.56	.36	.648	2.70	....	154.00‡	295.00‡	.50	2.00	54.4	43.4	51.6	40.1
Detroit	70.75	.455	8.775	3.375	8.50*l*	170.00‡*m*	263.00‡*m*	.40	1.75	63.1	52.1	60.6	49.1
Kansas City	71.73	.345	.625	2.47	6.85	173.00	312.00	.45	1.60	60.1	49.1	57.2	45.7
Los Angeles	84.40	.36†	.648†	2.988	7.47	130.50	217.50	1.25	2.50	....	....	....	....
Minneapolis	73.83	.44†*o*	.825†*o*	3.24†*o*	....	.....	.....	.90	2.40	60.2	49.2	57.3	45.8
Montreal	74.20	.85*k*	1.50*k*	5.25*l*	8.50*el*	45.00*j*	64.00*j*	.811*j*	2.51*j*	....	....	....	....
New Orleans	67.78	.31	.558	3.558	....	112.00	.....	...	....	58.0	47.0	55.5	44.0
New York	69.60	.52	.96	3.82	9.18	.....	.....	.60	1.40	61.5	50.5	59.0	47.5
Philadelphia	68.10	.40	.7735	3.20	8.50	200.00	275.00	.80	2.15	61.9	50.9	59.4	47.9
Pittsburgh	71.18	.322†*m*	.631†*m*	2.70†*m*	6.625*m*	124.20	193.80	1.05	2.50*g*	65.25*t*	54.25*t*	62.75*t*	51.25*t*
St Louis	68.84	.351*n*	.632*n*	2.527*n*	5.60*n*	105.80	212.00	1.00*h*	2.15*i*	61.9	50.9	58.6	4.71
San Francisco	84.40	.3875*d*	.6975*d*	2.79	6.975	124.50	207.50	.58	2.34	....	....	....	....
Seattle	86.20	.4375*b*	.7875*b*	3.15	....	.....	.....	.56*f*	1.60*f*	....	....	....	....

‡ Delivered. † F.o.b. *a* B. & S. class B and heavier, C/L lots, Burlington, N. J. (base) $66.00. Based on existing freight rates; subject to rate change. Gas pipe and class A, $5 per ton additional. 4 in., $5 per ton additional, 30 in. and larger, usually $1 per ton less. *b* Double strength. *d* List. *e* 30 in. *f* Less 5% for cash. *g* Culvert pipe. *h* Reinforced; spec. C–76–37. *i* Reinforce, spec. C–75–37. *j* Centri-spun. *k* Less 50%. *l* Less 53%. *m* Truck delivery. *n* Less 3% for cash. *o* Since carload lots are not available at this time, listed price is based on LCL (no minimum).

s Discounts from standard list consumers carload prices. Base price approx. $200 per net ton. List prices per ft.: ¼ in., 8¼c.; ⅜ in., 11¼c.; 1 in., 17c.; 2 in., 37c.; 2½ in., 58¼c.; 3 in., 76½c.; 4 in., $1.09; 6 in., $1.92; 3 percent tax on transportation costs not included. *t* Within switching limits. WROUGHT IRON PIPE: List prices per ft. same as wrought steel pipe. Discount for Pittsburgh base. Buttweld — 1 in. and 1¼ in. black, 34, galv., 16; 1½ in. black, 38, galv., 18⅓; 2 in. black, 37½, galv., 18. Lapweld — 2½ in. to 3½ in. black, 31½, galv., 14½; 4½ in. to 8 in. black, 32½, galv., 17. Freight rates to destination to be added to name delivered price.

LUMBER, TIMBER, PLYWOOD—PER M FT., B.M., CARLOAD LOTS F.O.B.

	SHORT LEAF YELLOW PINE AND DOUGLAS FIR — All S. L. Y. P. a No. 2 common or better and for No. 1 N C Box. (Prices in Bold Face)									LONG LEAF Y. P Merchantable grade		PLYWOOD Rail freight increment (See note for base price)	
	All Fir planks No. 2 common, Fir timber is No. 1 common. Lengths up to 20 ft (Prices in italics)									up to 20 ft.			
	1x6 s'e	1x8 s'e	2x4 s'e	2x6 s'e	2x8 s'e	2x10 s'e	3x12 Rgh	6x12 Rgh	12x12 Rgh	2x12 Rgh	12x12 Rgh	3/8"	1/4"
Atlanta	$48.25	$48.25	$46.75	$46.25	$47.25	$49.75	.....	.....	.....	$71.00	$71.00	$17.72	$21.37
	62.50	*62.50*	*61.00*	*61.00*	*60.00*	*60.00*	*$54.00*	*$53.50*	*$52.50*	.....	.....	.....	.....
Baltimore	74.00	75.00	71.00	70.00	70.00	77.00	90.00	.....	.....	185.00	180.00	18.45	21.995
	80.00	*82.00*	*80.00*	*74.00*	*79.00*	*80.00*	*95.00*	*87.00*	*85.00*	.....	.....	.....	.....
Birmingham	85.00	85.00	84.50	83.50	84.50	87.50	108.00	.....	.....	107.50	110.00	17.245	20.795
[1]	*90.00*	*90.00*	*89.50*	*88.50*	*89.50*	*92.50*	*112.00*	*95.00*	*96.00*	.....	.....	.....	.....
Boston	70.00[3]	72.00[3]	66.50[3]	62.50[3]	70.50[3]	74.50[3]	70.25[3]	.....	.....	.....	.....	18.195	21.995
	64.75	*64.75*	*62.75*	*63.25*	*62.75*	*62.75*	*60.50*	*59.50*	*59.50*	*59.50*	.....	.....	.....
Chicago ‡	65.00	66.00	62.00	62.00	62.00	69.00	75.00	.....	.....	97.00	97.00	14.555	17.555
	65.50	*65.50*	*65.50*	*65.50*	*65.50*	*66.50*	*67.50*	*63.00*	*64.00*	.....	.....	.....	.....
Cincinnati	51.00	52.50	46.00	46.00	48.00	56.00	70.50	.....	.....	68.50	68.50	17.245	20.795
Cleveland	58.50	58.50	56.50	55.50	56.25	58.25	65.00	.....	.....	.....	91.75	17.615	21.265
	64.50	*64.50*	*58.50*	*54.50*	*54.50*	*55.75*	*63.75*	*58.75*	*57.75*	.....	.....	.....	.....
Dallas	54.50	54.50	52.75	51.75[j]	52.25	54.00	56.50	59.50	59.50	89.75	86.00	14.555	17.555
Denver	*77.25*	*77.25*	*73.50*	*73.50*	*72.50*	*73.50*	*74.50*	*76.00*	*76.00*	.....	.....	10.285	12.435
Detroit	90.00	90.00	87.00	87.00	87.00	93.00	100.00	.....	.....	95.00	110.00	17.245	20.795
	98.00	*98.00*	*96.00*	*97.00*	*97.00*	*100.00*	*105.00*	*105.00*	*110.00*	.....	.....	.....	.....
Kansas City [a]	76.00	76.00	74.00	72.75	73.25	76.00	95.00	.....	.....	95.00	100.00	12.605	15.205
	78.00	*78.00*	*77.50*	*77.50*	*75.50*	*77.00*	*78.00*	*95.00*	*95.00*	.....	.....	.....	.....
Los Angeles [a]	*74.00*	*74.00*	*74.00*	*74.00*	*74.00*	*74.00*	*80.00*	*79.50*	*79.00*	.....	.....	9.81[gh]	11.86[gh]
Minneapolis ‡[b]	84.00[3]	82.50	.....	.....	.....	.....	.....	.....	.....	.....	.....	13.765	16.615
‡	*85.00*	*85.00*	*79.75*	*80.00*	*78.75*	*80.25*	*74.50*	*76.25/84.25*	*78.75/84.75*	.....	.....	.....	.....
Montreal [e]	69.00	70.00	64.00	68.00	70.00	75.00	.....	.....	.....	.20[i]	.20[i]	.....	.....
	97.00	*97.00*	*97.00*	*97.00*	*97.00*	*97.00*	*87.00*	*87.00*	*87.00*	.....	.....	.....	.....
New Orleans	42.00	42.00	39.00	38.50	34.00	42.00	46.00	.....	.....	54.50	69.00	14.555	17.555
	36.00	*36.00*	*34.50*	*34.50*	*33.50*	*33.50*	*33.00*	*29.50*	*29.50*	.....	.....	.....	.....
New York ‡	Range from $95.00 to $110.00						$105 to $120	.....	.....	.....	.....	18.195	21.995
‡	*Range from $90 to $120*									.....	.....	.....	.....
Philadelphia	85.00	85.00	85.00	85.00	85.00	85.00	85.00	.....	.....	140.00	140.00	18.195	21.995
	90.00	*90.50*	*90.00*	*90.00*	*90.00*	*90.00*	*90.00*	*100.00*	*100.00*	.....	.....	.....	.....
Pittsburgh	59.40	61.80	71.35	63.60	69.45	73.10	84.85	.....	.....	130.60	141.00	17.88	21.63
	77.60	*76.70*	*74.70*	*73.90*	*73.80*	*74.35*	*91.35*	*96.85*	*96.85*	.....	.....	.....	.....
St Louis	71.50	71.50	70.50	69.25	70.00	72.50	82.75	*83.25*	*82.00*	107.00	04.25	14.555	17.555
San Francisco [d]	*76.00*	*76.00*	*72.25*	*72.25*	*71.25*	*71.25*	*66.00*	*62.50*	*62.50*	.....	.....	7.33[g]	8.83[g]
Seattle	*50.50[a]*	*50.50[a]*	*50.50[a]*	*50.50[a]*	*50.50[a]*	*50.50[a]*	*45.00[a]*	*45.00[a]*	*45.00[a]*	.....	.....	.....	.....

Bold Face type, Southern Pine. *Italics, Douglas Fir.* [1] Long leaf [2] Roofers' N. C. Pine. [3] Spruce. [4] Native. [5] Western Pine, No. 3 Common. [7] Spruce. [8] Norway Pine. ‡ Delivered. *a* Yard prices. *c* 5M ft. or less. *d* Sales through wholesale distribution yard (F.o.b. purchaser's truck or carrier, San Francisco paid). *e* Plus sales tax. *f* Up to 18 ft. *g* Lower rate by water shipment. *h* 50,000 lb. minimum. *i* FBM, scarce, no stable quotation, no ceiling.

Note: Special concrete form grade Fir Plywood, 4' by 8' panels, 5-ply, sanded 2 sides, water resistant glue, carload lots, delivered per 1,000 sq. ft. surface. Seattle base price on 1/8", $95.15; on 1/4", $104.85; price includes oiling and sealing charges. For other centers add rail freight increment from table or proper size. For resin dipped treatment, add $10.50 per M.

GLASS, EXPLOSIVES, CHEMICALS

	WINDOW GLASS — Discounts from jobbers list, Aug. 15, 1938 Single or Double Thickness		EXPLOSIVES — Per lb. 40% Ammonia Gelatin in 50 lb. cases delivered in 200 lb. lots*
	A quality	B quality	
Atlanta	74%	75%	$0.18
Baltimore	78%	79%	.18
Birmingham	76%	76%	.135
Boston	77%	78%	.18
Chicago	725%	725%	.18
Cincinnati	77–10%	77–10%	.18
Cleveland	77%	77%	.22
Dallas	76%	76%	.1925
Denver	72%	72%	.185
Detroit	77%	77%	.18
Kansas City	77–10%	77–10%	.18
Los Angeles	86%d	88%d	.1875
Minneapolis	73%	73%	.175
Montreal	40–5%ab	47%ac	.1975
New Orleans	70%	75%	.19
New York	76%e	77%e	.25f
Philadelphia	74%	75%	.18
Pittsburgh	77%	77%	.1525
St. Louis	77–10%	77–10%	.185
San Francisco	66%	73%	.185
Seattle	75%	75%	.1875

Price of 60% Ammonia Gelatin is $0.01 per lb. higher than 40%

a Discount from list Sept 1939: sales tax included, but 6% tax exemption not allowed for. *b* Single thickness. *c* Double thickness. *d* Discount from jobbers' list Sept. 15, 1928. *e* Discount from jobbers list Jan. 16, 1946. *f* In borough of Kings, Queens and Richmond, and in Manhattan south of Canal St., add delivery charge of $6.00 per trip.

* Urban prices influenced by service charges or local storage and delivery regulations do not consistently reflect quantity prices in less congested areas.

40% Ammonia Gelatin price ranges in other than urban areas, per lb. (except Seismograph Grades)

	C/L 20,000 lb. net	Tons	200 lb. lots
E. of the Miss., except Fla. and Me.	$0.135	$0.16	$0.18
W. of Miss. to Rocky Mtn. States, Fla. and Maine.	.14 –.1475	165 –.1775	.185 –.1975
Rocky Mtn. States	.14 –.1525	.165 –.1825	.185 –.2025
Pacific N W States	.1375–.15	.1675–.18	.1875–.20
Pacific S W. States	.1350–.1425	.165 –.1725	.185 –.1925

PILES, TIES F.O.B.

PILES

Prices per linear foot, fir and pine, bark on, f.o.b. cars, New York. Fir based on Wash. and Ore. points to New York shipping area; pine based on freight from Norfolk.

Dimensions	Points	Length	By Rail — Pine *	Fir
12 in. at butt	6 in.	30 to 50 ft.	$0.34	....
12-in.—2 ft. from butt	6-in.	50 to 59-ft.	.35	....
12-in.—2 ft. from butt	6-in.	60 to 69-ft.	.36	....
12-in.—2 ft. from butt	6-in.	90 to 100-ft.	....	.56
13-in.—3-ft. from butt	5-in.	91 to 100-ft.	....	.58
14-in.—2-ft. from butt	6-in.	50 to 69-ft.	.41	.65
14-in.—2-ft from butt	6-in.	70 to 79-ft.	.43	.59
14-in.—2-ft from butt	5-in.	80 to 85-ft.	.54	....
14-in.—2-ft from butt	5-in.	85 to 89-ft.	.57	....
14-in.—2-ft from butt	5-in.	90 to 100-ft.	....	.64

* Pine piling over 80-ft. available only in limited quantities.

RAILWAY TIES

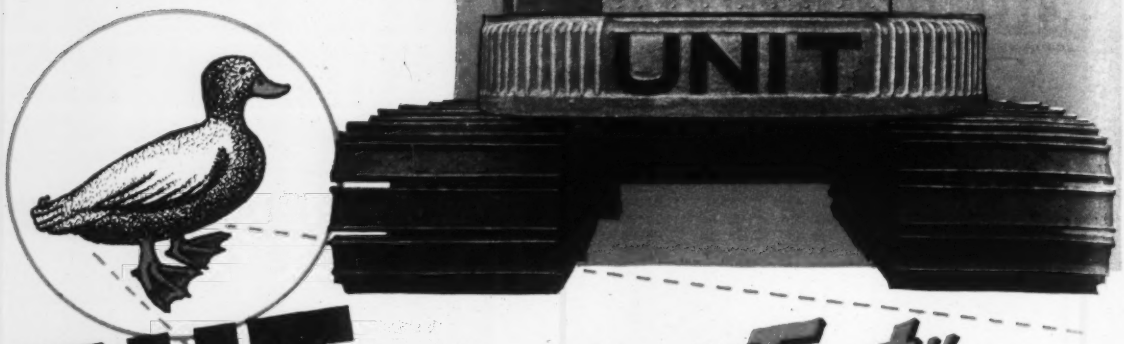
Prices f.o.b. per tie for carload lots:		6"x8"x8' Untr.	6"x8"x8' Tr.	7"x9"x8'6" Untr.	7"x9"x8'6" Tr.
Boston	Oak	$1.50	.....	$2.00	.....
	Pine	2.00	$3.00a	2.50	$3.00a
New York	S. L. Sap Pine	1.43/1.54	2.59	1.76	2.86
	Mixed Oak	1.71	2.59	2.42	3.58
Birmingham	Hardwood	1.00	1.60a	.....	2.25a
Chicago	Red Oak	.....	2.45/2.65a	.....	3.35/3.60
Los Angeles	Douglas Fir	2.10	3.35a	3.00	4.80a
Philadelphia	Red Oak	.....	2.10gg	.....	3.25gg
St. Louis	White Oak	1.80	.....	2.40	.....
	Red Oak	1.73	2.25a	2.19	3.25a
	Sap Pine or Cypress	1.80	.....	2.06	.....
San Francisco	Douglas Fir	1.25bd	.....	.....	3.00ca/
Montreal	Birch or Maple	.....	1.65	1.04	.....

Tr.—Treated; Untr.—Untreated. *a* Creosoted. *b* 6"x8"x8'6". *c* Empty cell. *d* Zinc. *e* Green. *f* F.o.b. cars. † Out of market. *g* January 1943 price, none later available.

CHEMICALS

Water, sewage treatment, road work, f.o.b. carlots, New York

Bleaching powder in drums f.o.b. works, per 100-lb	$2.50– 3.10
Chlorine cylinders, liquid, per lb. delivered	.0525
Calcium chloride, 77–80%, flaked, 100-lb. paper bag, del'd, ton	18.50–35.00
Silicate of soda, 52 deg., in drums, f.o.b. works, per 100 lb	1.40
Soda ash, 58%, in paper bags, per 100 lb. dense	1.15
Sulphate of aluminum, commercial, in 100-lb. bags	1.15–1.20
Sulphate of copper, in bbl., per 100-lb	5.00

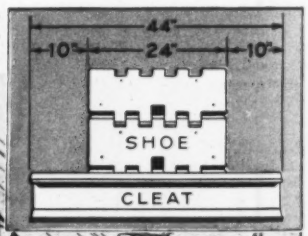


UNIT "Webbed Feet" FOR SOFT, LOAMY SOIL!

Every UNIT Crane or Shovel can be equipped with broad, heavy duty cleats that practically *double* the bearing surface of the machine and make it possible to travel over soft, loamy soil. Ideal for use in swamplands... sugar plantations . . . in fact, wherever the soil is too soft or marshy for the ordinary excavator. UNIT "Webbed Feet" broaden the scope of your machine . . . enable you to go places formerly impenetrable. They make your machine more versatile . . . more PROFITABLE!

Cleats are bolted to the crawler shoes and are quickly detachable. A special arched axle adds stability and provides additional clearance between the machine and the ground.

Note that cleats practically double the bearing surface of machine.



CONTACT FACTORY DIRECT For Price and Delivery

UNIT CRANE & SHOVEL CORP. 6315 WEST BURNHAM STREET MILWAUKEE 14, WIS., U. S. A.

STRUCTURAL CLAY BUILDING TILE, BRICK AND LIME—DELIVERED

	STRUCTURAL CLAY TILE PARTITION — SCORED Per M. lots of 2,000 pieces or over, 3x12x12 in.	4x12x12 in.	8x12x12 in.	STRUCTURAL CLAY TILE — LOAD BEARING — SCORED Per M. lots of 2,000 pieces or over, 8x12x12 in.	10x12x12 in.	12x12x12 in.	BRICK Per M. in quantity Common backing	Straight hard	LIME Per ton, Hydrated finishing	In paper, Common hydrated	Carload lots, Pulverized, or lump
Atlanta	$112.50	$132.60	$234.60	$244.80	$273.40	$306.00	$24.00	$24.00	$19.00	$17.50	$17.50
Baltimore	90.00	95.00	175.00	200.00	260.00	300.00	23.75*k*	29.75*k*	20.00	15.00	2.50*ss*
Birmingham	91.00	96.00	133.00*c*	216.00	.....	.....	18.50	21.00	19.11	15.05	16.05
Boston	105.00†	112.00†	210.10†	252.09†	.....	.....	20.00*i*	20.00*i*	21.00†	.....	16.00
Chicago	92.10	98.40	185.20	.....*x*	.....*x*	.....*x*	18.50	19.50	18.00	16.00	.....
Cincinnati	75.39	80.39	150.90	170.91	242.35	277.25	33.00	33.00	16.90	14.40	.....
Cleveland	98.10	104.55	.....*x*	196.00	.....	.....	24.00	24.00	17.05	14.55	19.55
Dallas	77.25	83.00	165.00	198.00	254.50	315.00	17.25	19.00	19.00	15.00	15.00
Denver	105.25	119.00	198.25	230.00	263.50	315.25	26.50	28.00	30.00*j*	28.00*j*	34.00
Detroit	92.70	96.70	174.50	198.80	257.20	294.30	24.00*f*	25.00*f*	22.00	20.00	20.00
Kansas City	.....	.....	.....	.....	.....	.....	17.50	18.50	30.40	24.00	24.00
Los Angeles	87.50†*r*	103.00†*r*	142.00c†*r*	217.50†*r*	375.00†*r*	470.00†*r*	16.50	18.50	16.50	17.50	17.50
Minneapolis	.....	.....	.....	.....	.....	.....	18.50*s*	.....*g*	29.20*bb*	21.00*bb*	22.00*bb*
Montreal	92.50*a*	98.50*a*	196.25*a*	151.50*a*	.....	294.40*a*	22.16†*u*	29.41†*u*	12.50*u*	14.00*u*	8.00*u*
New Orleans	104.50	109.55	207.25	222.25	326.90	385.65	17.75	.....	18.30	12.08	14.10
New York	103.90	110.80	152.35	164.20*hn*	.....*x*	.....*x*	25.50	.....	27.60	22.80	.....
Philadelphia	112.10	119.60	224.20	269.10	321.20	405.10	24.75	27.75	22.00	18.00	17.00
Pittsburgh	98.50	105.80	181.85	217.30	265.85	303.10	23.25	25.25*y*	19.40*cc*	16.90*cc*	2.85*m*
St. Louis	.....	.....	.....	.....	.....	.....	26.00*s*	25.00*s*	24.00*s*	20.00*s*	...68*s*
San Francisco	102.40	115.20	153.60	115.20*r*	.....	.....	25.00	.....	20.90	20.90	2.08*m*
Seattle	129.25	141.50	.....*x*	141.50*cc*	.....	.....	23.00*k*	28.00*k*	27.95*s*	27.95*s*	3.28*m*

* F.o.b. *a* Smooth. *b* Carload lots delivered to job. *c* 6 x 12 x 12 in.-3 cell count 10 days. *s* 2% discount for cash. *t* 5½ x 8 x 11½. *u* 8% sales tax included. *x* Not available. *y* Stacked. *z* Pebble lime, price per 80 lb. sack. *bb* LCL, delivered. *cc* Truck delivery. *f* Includes $3.50 per M. for delivery. *g* No quotation. *h* F.o.b Perth Amboy, N. J. *i* F.o.b. Warehouse only. *j* OPA Price. *k* $1.00 discount. *m* Per bbl., 180 lb. *n* 7½ x 7½ x 12 Speed tile. *o* Per bbl., 200 lb. *r* 5% dis-

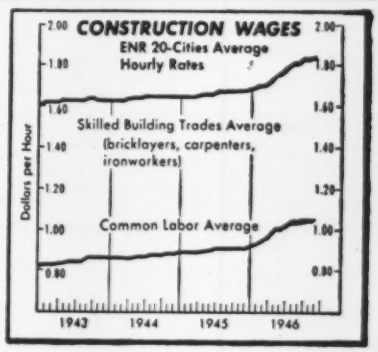
PAINT, ROOFING—F.O.B. CARLOAD LOTS

	RED LEAD Per 100 lb. in 600-lb. (Approx.) bbl. Dry *a*	WHITE LEAD Per 100 lb. in 100 lb. cases Reverse order In oil *w*	READY-MIXED PAINT Graphite *b*	Per gal., drums Aluminum *c*	Ferric Oxide *d*	ROOFING SUPPLIES Carload lots f.o.b. factory Rolls, slate surfaced, 85–90 lb. per sq.	Asphalt felt, per 100 lb.	Tar felt, per 100 lb.	Asphalt coating per gal	Tar pitch 360 lb. bbl. per ton
Atlanta	$15.50	$23.625	$1.75	$2.70	$1.65	$2.06	$2.06	$2.06	$1.00	$36.00
Baltimore	15.25	23.25	2.00	3.00	2.50	2.35	2.90	2.90	.40	29.00
Birmingham	15.50	23.625	2.54	4.00	2.25	2.35	2.27	2.27	.33	29.42
Boston	15.25	23.25	1.75	2.50	2.31	2.00‡*h*	3.30‡*ut*	3.30‡*ut*	.25‡	21.00‡
Chicago	15.25	23.25	....	....	....	1.75*hf*	1.99*hf*	1.99*hf*	.33*f*	23.00*f*
Cincinnati	15.25	23.25	1.70	2.90	1.60	2.20	2.10*h*	2.10*h*	.33	25.00
Cleveland	15.25	23.25	....	....	....	1.71	1.63*h*	1.61*h*	.237	25.00
Dallas	15.25	24.00	1.88	2.95	.06*l*	1.89*h*	2.00*h*	2.00*h*	.65	37.00
Denver	15.25	23.75	2.22	4.11	2.82	2.53	2.36*h*	2.36*h*	.29	29.00
Detroit	15.25	23.25	1.75	3.00	1.60	2.25	2.25	2.25	.50	23.00
Kansas City	15.25	23.375	2.30*g*	2.55*g*	2.16*g*	2.50	2.75	2.75	.52	.....
Los Angeles	15.50	23.75	2.30	3.00	2.75	2.25	1.65	....	.50	.....
Minneapolis	15.25	23.125	....	....	....	1.90*i*	1.85*hi*	1.85*hi*	.32	23.00
Montreal	.....	.....	2.50*p*	4.90*p*	3.15*p*	2.85	2.45*t*	2.45*t*	.84	1.83*tk*
New York	15.25	23.25	2.91	....	2.70	1.995	2.0465*o*	2.0465*o*	.26	26.00
Philadelphia	15.25	23.25	1.60/1.80	2.20	1.55	2.30	2.81	2.81	32	23.00
Pittsburgh	15.25	23.25	1.95	2.40	1.75	2.15	2.09*h*	2.09*h*	.34	27.00
St. Louis	15.25	23.25	2.28*s*	2.89*s*	1.96*s*	2.01*h*	2.01*h*	2.01*h*	.46	28.00
San Francisco	15.50	23.50	1.80	2.75*n*	1.35	1.7613	4.72	2.472	.3399	21.115
Seattle	15.50	23.75	1.95	3.09	....	2.22	2.23*h*	....	.36	31.93*j*

‡ Delivered. Note: Red lead in oil 50c higher than white lead in oil. *a* Red lead prices change frequently due to pig lead price changes. *b* U. S. War Dept. Spec. 3-49A. *c* ASTM Spec. D266-31. *d* 80% minimum ferric oxide. *f* Distributors' price to contractors. *g* 55 gal. can. *h* Per roll, 65 lb. *i* Minneapolis and vicinity. *j* Asphalt pitch. *k* per cwt. *n* May, 1941 price. *o* 60-lb. roll. *p* Plus 8% sales tax. *s* December, 1942 price. *t* Federal tax included. *u* 90-lb. roll. *z* Truck delivery. *w* Price to large paint contractors is $1.25 less.

SKILLED AND COMMON WAGE RATES—PER HOUR

	Bricklayers	Car penters	Struct. Iron Workers	Hoisting Engineers	Plasterers	Common Labor Building	Common Labor Heavy Const.
Atlanta	$2.00	$1.50	$1.625	$1.50	$1.62	$0.75	$0.30
Baltimore	1.90	1.775	2.00	1.625/2.00	1.90	.95	.95
Birmingham	1.9375	1.50	1.625	1.50	1.65	.65	.65
Boston	1.725	1.75	1.85	1.65	1.667	1.25	1.25
Chicago	2.00	1.95	1.95	1.95	2.00	1.30	1.30
Cincinnati	1.875	1.65	1.775	1.875/2.125	1.875	.95	.95
Cleveland	2.125	2.025	2.125	2.125	2.125	1.375	1.375
Dallas	1.9375	1.425	1.625	1.625	1.75	.80	.80/1.25
Denver	1.98*b*	1.70	1.70*b*	1.70*b*	1.90	1.10	1.10
Detroit	2.00	1.825	2.00	1.85/2.00	2.00	1.275	1.275
Kansas City	2.00	1.75	1.875	1.875	2.00	1.175	.90
Los Angeles	2.00	1.75	2.00	1.65	2.05	1.25	1.25
Minneapolis	1.825	1.65	1.75	1.70	1.90	1.15	1.15
New Orleans	1.625	1.375	1.625	1.55	1.625	.70	.80
New York	2.25*b*	2.10*b*	2.25	2.25*b*	2.25*b*	1.25	1.25
Philadelphia	2.00/2.25	1.775	1.90/2.00	2.25	2.00/2.25	1.025	1.025
Pittsburgh	2.15	2.00	2.00	2.05	2.00	1.15	1.15
St. Louis	2.00	1.95	2.00	2.20	1.90	1.00	1.00
San Francisco	2.05	1.75	2.00	1.85	2.00	1.25	.125
Seattle	1.975	1.675	1.80	1.90	1.975	1.275	1.30
Montreal*	1.17	1.06	1.11	1.07	1.17	.62	.65



b 7 hr. day. * Cost of living bonus now included in basic wage.

ENR Skilled Average: (Bricklayers, Carpenters, Ironworkers) $1.863.

ENR Common Average: $1.085.

Another good example of

the Simplicity and Economy of

SINCLAIR'S IMPORTANT NO. 2 DOCK AT MARCUS HOOK BUILT WITH

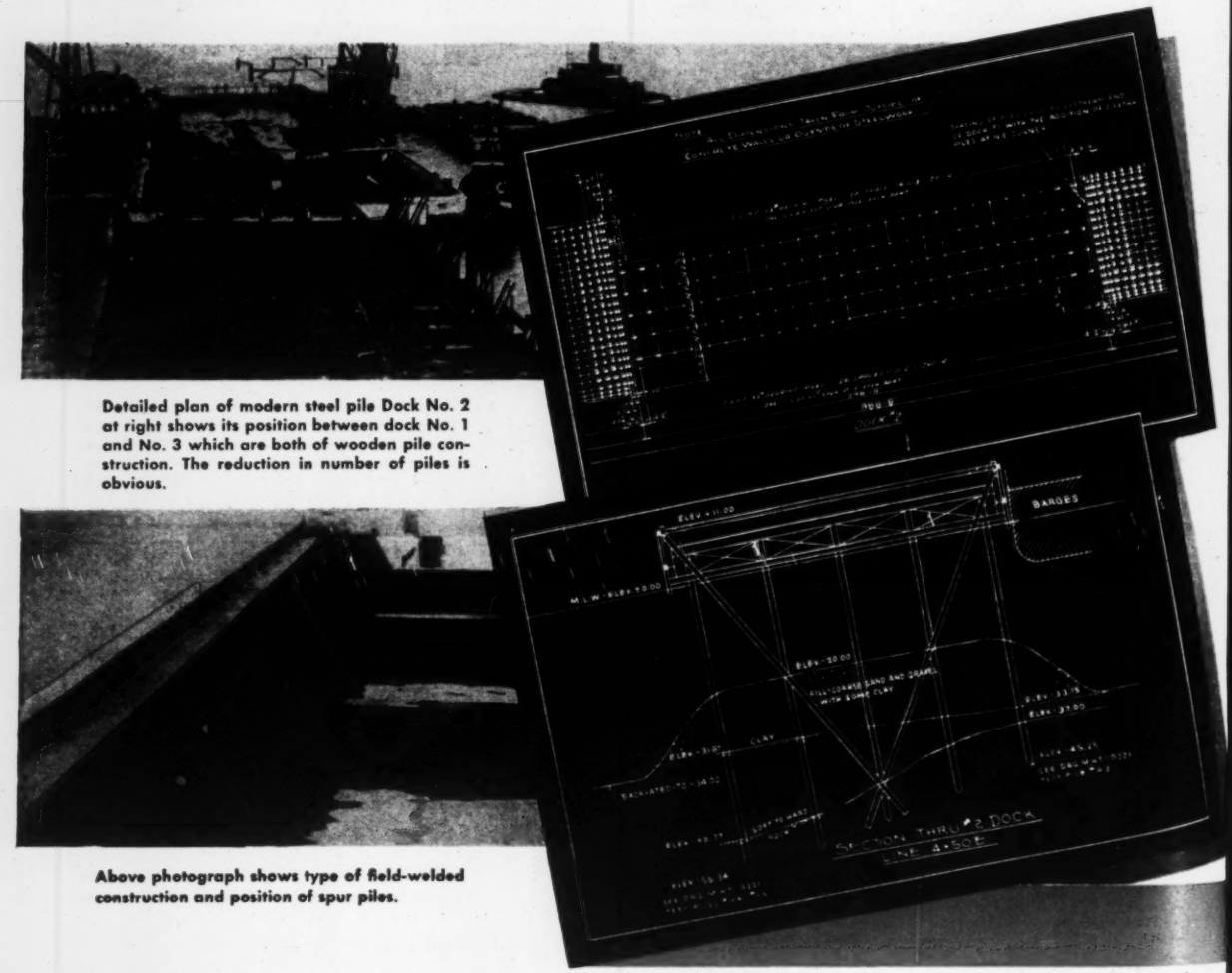
U·S·S BEARING PILES

THE ease and speed with which this Terminal dock was built . . . the trouble-free service it has given in nearly ten years of rugged use, further prove the superiority of steel bearing piles in modern pier construction.

298.8′ long and 65′ wide, this busy dock is supported by 189 field-welded U·S·S Steel Bearing Piles. They were driven five rows of 27 vertical piles, with spur piles welded to the two outside piles in each bent as shown herewith.

To take care of a light overburden, piles were driven almost directly into rock formation. In some instances, welded points were applied to ends of piles to facilitate load and stress distribution on the rock and in the lower end of the pile shaft.

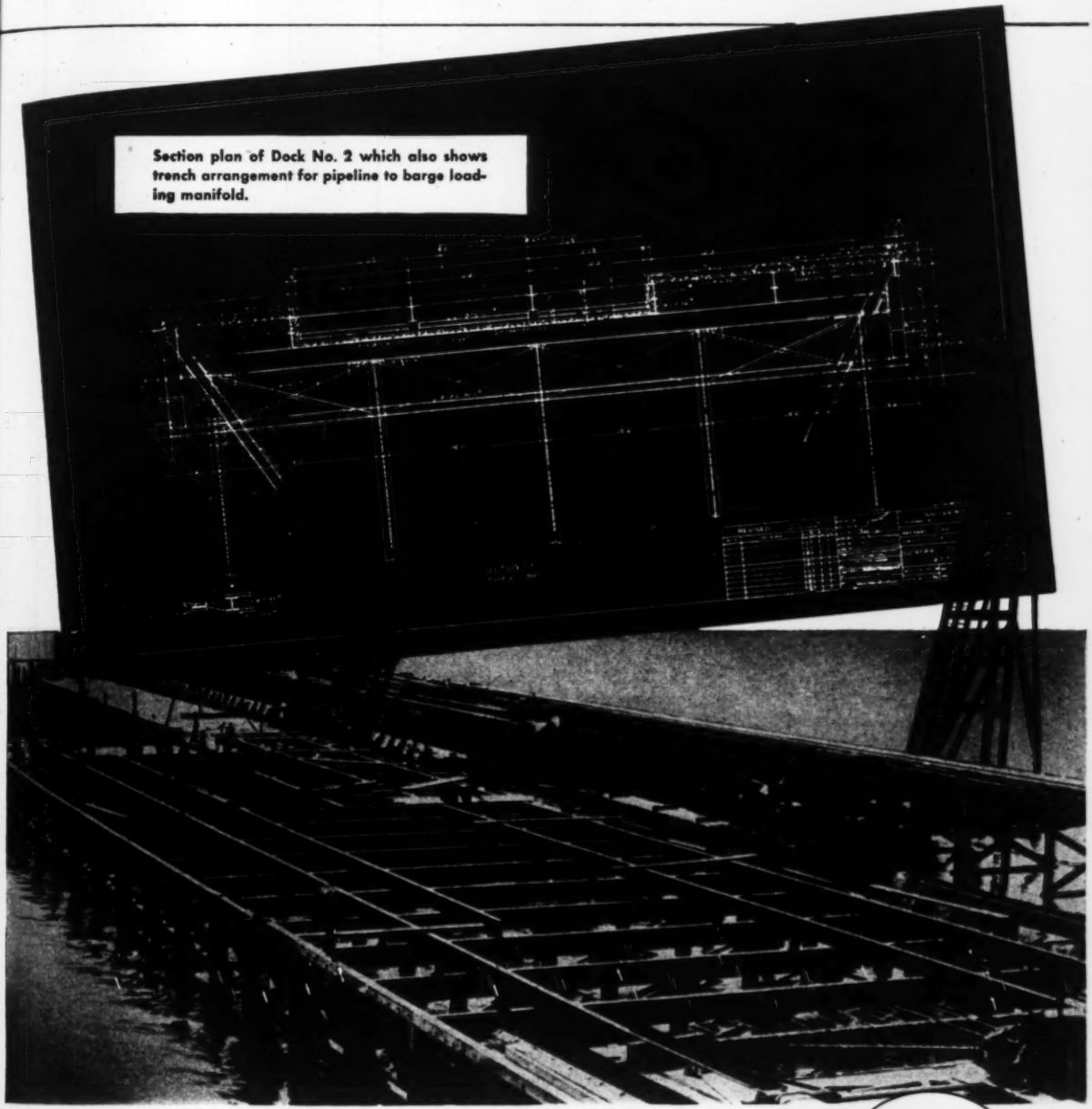
Whether conditions are usual or out-of-the-ordinary, U·S·S Bearing Piles provide a safe, economical means of supporting foundations or absorbing lateral shock. Their capacity for high unit loads means fewer piles and fewer driving operations. For detailed information on U·S·S Steel Bearing Piles and other U·S·S Engineering Products, please contact the office nearest you.



Detailed plan of modern steel pile Dock No. 2 at right shows its position between dock No. 1 and No. 3 which are both of wooden pile construction. The reduction in number of piles is obvious.

Above photograph shows type of field-welded construction and position of spur piles.

Steel in Modern Pier Construction



Section plan of Dock No. 2 which also shows trench arrangement for pipeline to barge loading manifold.

CARNEGIE-ILLINOIS STEEL CORPORATION
Pittsburgh and Chicago
Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
Tennessee Coal, Iron & Railroad Company, Birmingham, *Southern Distributors*
United States Steel Export Company, New York

USS STEEL
UNITED STATES STEEL

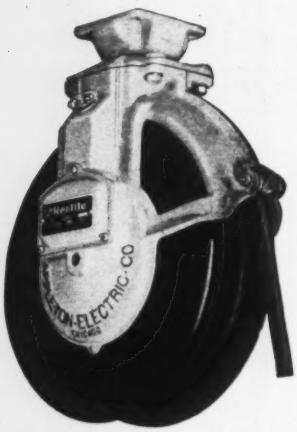
UNITED STATES STEEL

New Aids to the Constructor

MANUFACTURERS' LATEST DEVELOPMENTS IN EQUIPMENT AND MATERIALS

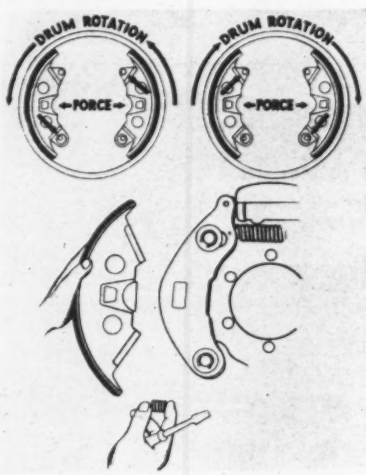
Reflective Roof Coating—A new roof coating, Richlume, is said to have unusual insulating, waterproofing, and fire-resistant qualities when applied with brush or spray to tar-and-gravel tar paper, built-up asphalt, or composition shingle roofs. Tests show Richlume to have high resistance to weathering, heat, cold and salt water, as well as the ability to waterproof any bituminous roofing material which is not actually torn open or cracked too widely to be bridged by Richlume as it is applied.

It is emphasized that this product is a coating developed for use on bituminous roofing materials only. A new plastic vehicle for the aluminum pigment is claimed to produce a close bond with roofing materials without penetrating below the roof surface.—*Richkraft Co., Chicago, Ill.*



Electric Cable Reel—The Appleton Type "YS" Reelite, for use with traveling hoists, automatically takes up and pays out conductor cable, with no exposed current collectors, trolleys or wires. It is specially designed to team up with any traveling electric hoist within its rated capacity. The reel serves any stretch of track—straight, or with one or more bends—up to double its cable length. For curved track, and certain straight track installations, the Reelite is furnished with swivel base, permitting rotation up to 335 deg.

Maintenance of the reel is simple; removal of outer covers is only dismantling required to fully service brushes and power spring, or to make solderless line connections direct to terminal block. There are oil-less bearings at all points of rotation.—*Appleton Electric Co., 1701-59 Wellington Ave., Chicago 3, Ill.*



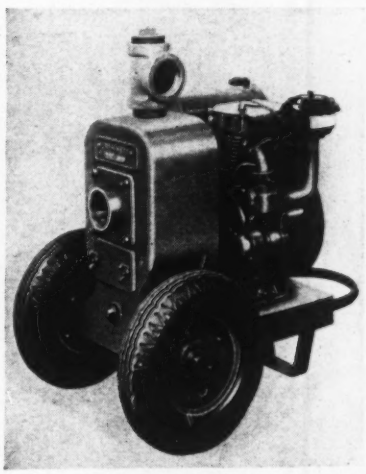
Hydraulic Brake—The Timken "DP" dual primary hydraulic brake is now being manufactured in a new heavy duty series. It is said to meet the needs of operators of big trucks who have long wanted a true heavy duty hydraulic brake big enough and powerful enough to meet the requirements of extra hard service. Its operating principle is identically the same as the medium duty series.

The brake is of rugged construction throughout and is fitted with the bars to provide straddle-mounting for the anchor pins. It is the only hydraulic brake, it is claimed, that has ¾-in. tapered liners and is mounted on an open type steel brake spider to provide low temperature operation. Removal dust shields are available if required.—*The Timken-Detroit Axle Co., Detroit 32, Mich.*

Blasting Fuse Cap—RDX, the war's most powerful chemical explosive, (*ENR* July 25, vol. p. 96) is the basic charge of the radically new "Big Inch" blasting fuse cap. The length of the new cap is hardly more than 1⅛ inches in length and less than ¼ in. dia. It is easier to bury completely in the smallest stick of dynamite and reduces the risk of its being struck with a tamping bar. The caps can withstand the shock of a heavy impact without detonating.—*Olin Industries, Inc., East Alton, Ill.*

Water Clarifier—The Liquon sludge contact reactor has been developed to efficiently combine the operations of mixing raw water with coagulating chemicals, properly agitating the mixture, maintaining a suspended deep sludge bed or blanket of previously accumulated precipitates, completely separating the clarified water from the sludge, and concentrating the impurity-saturated sludge for minimum volume of blow-off. Reactor is equally well adapted for coagulation of turbid, colored waters, for softening of hard well waters by lime-soda, for simultaneously softening and clarifying hard river waters, and for removal of iron, manganese, silica or fluorides from water.—*Liquid Conditioning Corp. 423 West 128th St., New York 27, N. Y.*

Lift Truck—A new Hyster pneumatic tire 4,000-lb. fork-type lift truck, termed the Hyster "40", uses a Wisconsin air-cooled motor, trunnion steering and 7.00 x 12 pneumatic tires. The truck is well adapted for use over any type of indoor or outdoor road surface.—*Hyster Co., Portland 8, Ore.*



Self-Priming Centrifugal Pumps—Quick and dependable self-priming action without priming valves or "recirculation" is an outstanding feature of the new Blue Brute line of portable self-priming centrifugal pumps. Efficient hydraulic design has produced pumping units which meet standard rating tables with liberal factors of safety in capacity and power.

Fabricated of corrosion and abrasion resisting steel, the pumps are rugged, light in weight and streamlined in appearance. All sizes except the smallest (1-1½ in.) are regularly equipped with

WHEN TIME MEANS MONEY

IT PAYS TO BE A CLOCK-WATCHER!

If hours mean dollars on your job, get out your watch to do a little checking. How long does it take *your* crew to install wireways, conduit or pipe hangars? Are they punching or drilling holes in steel members to bolt on clips or hangars? Are they juggling around with expensive two-piece clamping gadgets? If they are, come over to this typical NELSON automatic stud welding job and see how much time you've been losing.

The man pictured up there is "shooting" NELSON studs at the rate of 150 per hour. He's doing it with the 5-lb. NELSON stud welding gun, powered by a standard 400-amp. d.c. welding generator. All he does is load the stud and protective porcelain ferrule (furnished with the studs) into the gun chuck, contact the beam with the stud tip, and pull the trigger. Weld cycle is entirely automatic, regulated by the NELSON timer control unit. Welds are uniform, and weld strength exceeds that of the stud.

Sketched at right are a few typical NELSON stud welding applications on wireway, conduit and piping installations. Scores of other NELSON construction applications—securing corrugated roofing and siding, insulation wire lath and other collateral materials—offer savings you can't afford to miss. Write or wire *now* for prompt, helpful information.

Short studs speed installation of conduit, BX cable, outlet boxes, etc.

Shoulder studs (or female studs with cap screws) provide clearance for cables or conduit.

Wireway brackets are easily secured with short studs.

Typical use of studs on heavy cableway bracket.

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LORAIN, OHIO

Representing

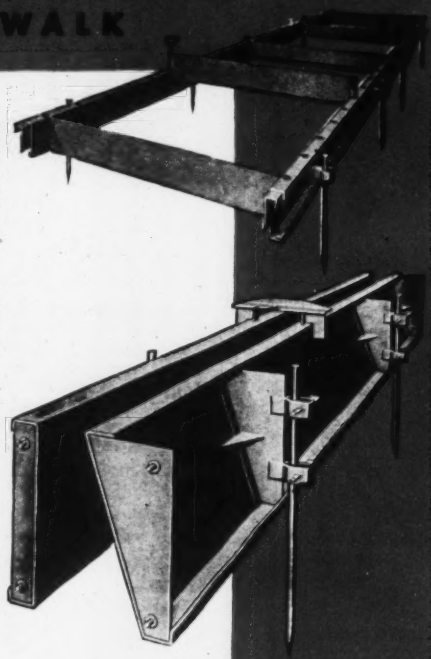
Nelson Stud Welding Corporation Lorain, Ohio	Nelson Specialty Welding Equipment Corporation San Leandro, California

NELSON

HOW TO

improve appearance and save money

ON CONCRETE CURB, GUTTER AND SIDEWALK



You buy Heltzel Steel Forms once. They stay in service for 20 years or more and each job you set is as uniform as the ones before. The low cost of the equipment per year of service plus the benefits of faster work with the use of forms net substantial savings.

Rigid, self-interlocking Heltzel Steel Forms make the setting and stripping job much easier and faster. No warping, no chipping, no replacements.

Heltzel has been engineering steel forms for 36 years. No matter how complicated or individual your specifications, we can furnish forms for your work.

Purchase of Heltzel Steel Forms for municipal sidewalks, gutters, and curbs enables cities and towns to establish a sound employment program. No other method for setting concrete offers so many advantages.

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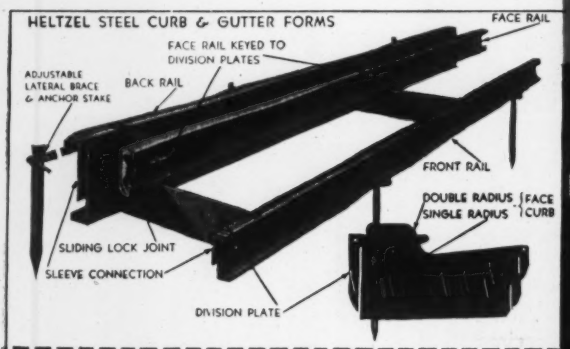

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(Type of construction usually engaged in)

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CURB FORMS
CURB AND GUTTER FORMS
SIDEWALK FORMS
SEWER AND TUNNEL FORMS
CONCRETE BUCKETS
SUBGRADE TESTERS
SUBGRADE PLANERS
TOOL BOXES
FINISHING TOOLS FOR CONCRETE ROADS

pneumatic-tired wheels, towing handles and lifting bales. The 1-½-in. pump is base mounted with lifting handle.—*Worthington Pump & Machinery Corp., Harrison, N. J.*

Elevating Endgate —Old-fashioned manual lifting for truck loading is replaced by smooth hydraulic power that lifts or lowers loads up to a ton in 10 sec. Unit is available for installation on any make of truck trailer—*Fruehauf Trailer Co., Detroit, Mich.*

Truck and Tractor Winches — Three sizes of truck and tractor winches are now in production: 15,000, 30,000 and 60,000-lb. pull. Instantaneous change in direction is achieved in this Rapid Reverse series at full load and under full speed by a single straight-line shift without engaging or disengaging engine clutch. Use of engine clutch is necessary only at beginning and end of job to engage and disengage the power take-off

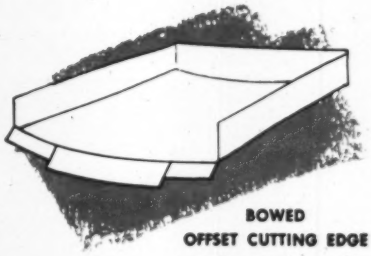
If operator lets go of lever, clutch returns to neutral and automatic brake on worm shaft stops all motion. This insures foolproof "deadman" control but the lever may be latched in to give positive engagement.—*Gar Wood Industries, Inc., Detroit 11, Mich.*

Generators —New series of A-C generators is made in both 8 and 10 poles, making it especially desirable for direct connection to 720 rpm. and 900 rpm. engines. Alternator can be furnished either with two bearings or single bearing to permit direct carriage of drive end of alternator on engine-driven shaft —*Kato Engineering Co., Mankato, Minn.*

Helmet Goggle—Model 500 goggle is completely adjustable to take care of various facial and head requirements

bigger pay loads are a cinch with . . .

the new LPC *Carrimor**



BOWED
OFFSET CUTTING EDGE

EXCLUSIVE
"FOUNTAIN ACTION"

Yes, Sir! You get bigger "pay loads" every time with an LPC "Carrimor". Moreover, you get them faster and with less power! Here's why: The "floating" front apron provides a generous initial opening for loading, without any movement of the tail gate. The bowed offset cutting edge gives you instant penetration in all kinds of material. The earth "fountains" up toward the center of the bowl until a full heaped load is obtained. Even in very loose material you can get full loads with amazing ease because LPC's exclusive, eccentric hoist sheaves produce a greatly accelerated downward throw in favor of the cutting edge, creating a "pumping" action that forces the load up into the bowl.

In addition to these features there are dozens of others that will cut minutes off your loading, hauling and dumping time while adding yardage to your pay loads. Compare the new LPC "Carrimors" with any other scraper you've ever used and you'll see why so many agree on LPC for lowest possible cost per yard. LaPlant-Choate Manufacturing Co., Inc., Cedar Rapids, Iowa; 1022 77th Ave., Oakland, Calif.

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A Self-Propelled

PNEUMATIC TIRE MOUNTED

Traveling Mixing Plant

New Wood Roadmixer Model 36 on Oklahoma State Highway job.

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The most talked about piece of road building equipment on the market. As easy to operate and maneuver as a motor patrol. Unequalled for such small jobs as shoulders, parking areas, detours, patch work and general maintenance, yet has plenty of capacity for any size job. Handles road oil, cut-back, tar, emulsion and soil cement mixes. Uses native or imported materials. Produces 100 to 150 tons of ready-to-spread mix per hour. See your Wood Roadmixer dealer or write direct for Bulletin 36.

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Detachable compass $13.75

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DAVID WHITE COMPANY

305 West Court St., Milwaukee 12, Wis.

and for wear over personal glasses. It can be worn in the on or off position. Facial fit of the cups, together with indirect ventilation, make this unit equally efficient for grinding, chipping or dust operations. Sweatband is wrinkle-free with wool felt lining; it is held in place with glove fasteners.—*Boyer-Campbell Co., 6540 St. Antoine St., Detroit 2, Mich.*

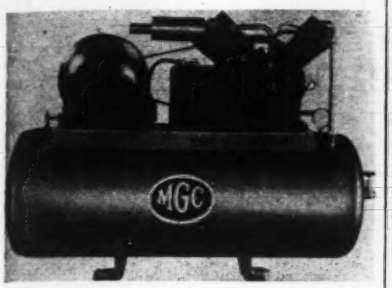
Flame Cutting Accessory -- Magnetic straight edge guide for flame cutting steel plates and shapes with a hand torch is made of specially heat-treated aluminum alloy that will not warp from heat, is lightweight and resistant to corrosion. Aluminum holders are provided with specially cast Alnico magnets which exert a 30-lb. pull and hold straight edge rigidly in place. Detachable holders can be secured at any point along the straight edge by means of thumb screw so that either, or both, ends can be extended beyond edge of plate. Holders are made with swinging arm that permits straight edge to be changed from right-angle cutting position to 30 deg. scarfing bevel by loosening thumb screw. — *Universal Power Corp., 765 Carnegie Ave., Cleveland 15, Ohio.*

Earth Boring Machine — Hydraulically controlled machine insures ease of operation and provides automatic regulation of cutting speed to suit the texture of the soil. All plumbing is hydraulically controlled, enabling faster operation and transportation from hole to hole. Hydraulic feed maintains a constant pressure on the bit maintaining the maximum rpm's on the auger without the slipping of any clutch or gears. Hydraulic pressure on bit transmits less shock to machine while digging in hard-to-drill soils. Hydraulic fingertip control reduces operator fatigue to minimum. Holes up to and including 24 in. dia. can be drilled, with hole depth 8 to 9 ft.—*Jaques Power Saw, Denison, Tex.*

Hard-Surfacing Electrode—Amsco Resistwear, a hard-surfacing rod, is a low cost, high carbon, chrome, molybdenum, shielded arc electrode that can be deposited on any ferrous base metal. It will produce, as deposited, hardness

of approximately 400 to 500 brinell, depending upon the degree of dilution from the base metal. It is ideal for a wide range of applications where it is desirable to protect ferrous parts, subjected to severe abrasion with or without impact, with an overlay of a more wear resistant material.

Resistwear is available in coated form only for AC and DC application in ⅛, 5/32, 3/16, and ¼ in. dia. by 14 in. long.—*American Manganese Steel Division of American Brake Shoe Co., Chicago Heights, Ill.*



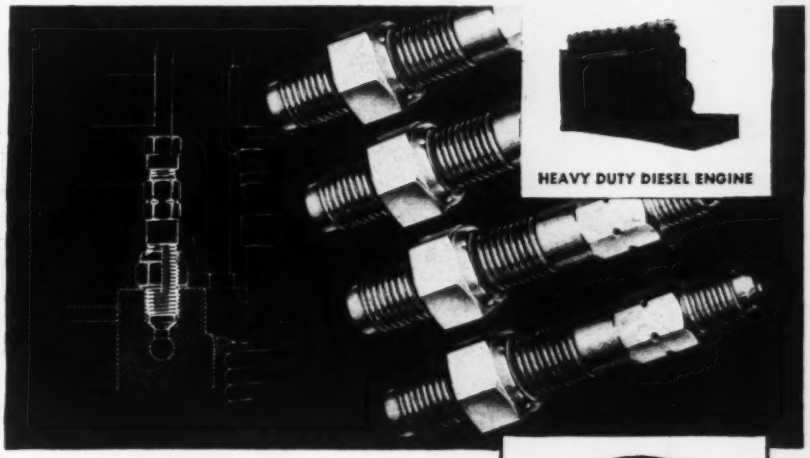
Two-Stage Air Compressors—Five new models of Super-Duty two-stage air compressors will be available in 7, 9, 13, and 21 cu. ft. capacities and all are furnished with 80 gal. storage tanks; a 60-gal. tank is optional with the 7 cu. ft. unit. The compressors are of the self contained type with motor and compressor mounted on a one piece steel sub-base which in turn is electrically welded to an 80-gal. horizontal air receiver. They are fully automatic and controlled by centrifugal type unloading valves which guarantee against motor burnout.—*Motor Generator Corp., division of The Hobart Bros. Co., Troy, Ohio.*

Split Stud—A new split stud for securing insulation and similar materials to metal supports or surfaces resembles a cotter pin in appearance. It is designed for automatic welding in Nelson stud welders. The solid or closed end is welded to the support or surface, leaving the split end projecting.

Welding is accomplished at the rate of 100 to 200 studs per hour. The welding gun weighs 5 lb. and is as portable as an electric drill. The weld cycle is entirely automatic. The studs are available in diameters from ⅛ to ¼ in. and in lengths up to 3 in.—*Nelson Sales Corp., Lorain, Ohio.*

Hydraulic Governors—A new principle of governing, combining hydraulics and centrifugal force, has resulted in four standard types of governor, automotive, constant speed, overspeed shutoff and universal. The governors, adapted to

SELF-SEALING *Prevents Oil Seepage* **ALONG FUEL LINE STUDS**



The Red Elastic Collar seals the threads tight against LIQUID SEEPAGE

Three important benefits result from the use of ESNA Elastic Stop Nuts on Diesel engine fuel line studs. *First,* operational safety. The Red Elastic Collar is self-sealing against fuel oil operating pressures up to 60 psi. *Second,* design simplification. The Red Elastic Collar is self-locking anywhere on the stud. It permits the use of straight threads—instead of individually gauged tapered threads—for the oil supply block connection. *Third,* faster assembly. Straight threads permit the accurate positioning of the studs between the block and fuel line—before the finished surface of the Elastic Stop Nut is fully seated and self-locked and self-sealed against the copper washer. The total result? Threefold economy!

Multiple protection—against Liquid Seepage, Vibration, Corrosion, Thread Failure and Costly Maintenance—has made Elastic Stop Nuts the standard fastener on many products. Standardization achieves the double economy of inventory simplification and reduced procurement costs. For further information address: Elastic Stop Nut Corporation of America, Union, New Jersey. Sales Engineers and Distributors are located in principal cities.

LOOK FOR THE RED COLLAR
THE SYMBOL OF SECURITY

It is threadless and permanently elastic. Every bolt—*regardless of commercial tolerances*—impresses (does not cut) its full thread contact in the Red Elastic Collar. This threading action produces a compressive, radial-reactive pressure against *both* the top and bottom sides of the bolt threads . . . insures a permanently tight, full contact between the bolt and nut threads . . . and makes all Elastic Stop Nuts self-sealing against Liquid Seepage.

As a result, all Elastic Stop Nuts protect permanently against thread corrosion and resultant failure.

ESNA
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ELASTIC STOP NUTS

PRODUCTS OF: **ELASTIC STOP NUT CORPORATION OF AMERICA**

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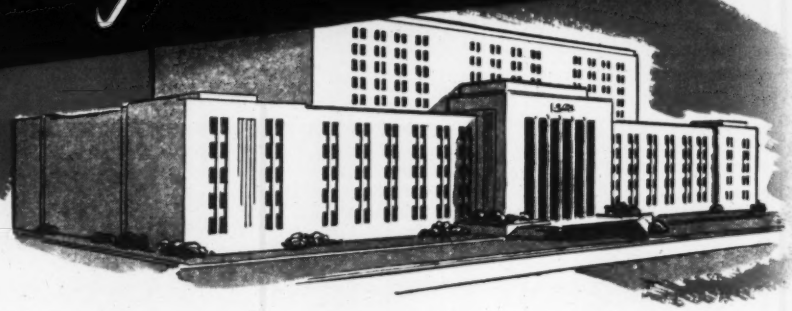


Plan well WITH THESE TRUSCON STEEL BUILDING PRODUCTS FOR HOSPITALS

● Truscon's complete line of building products affords you an opportunity to create safe, beautiful hospitals. When you plan with these time-proven units, you can be sure that your exact requirements will be met—sure, too, of fire-resistance, low installation and maintenance costs.

Check over the items listed on these pages. Every one of them is scientifically designed and factory produced. That's why buildings in which they are used have beauty and long life that enhances the reputation of architects and increases customer satisfaction.

Not all of these items are available now. But they will be soon. In the meantime for dependability, for responsibility, design Truscon Steel Building Products into all of the buildings you are now planning.

DONOVAN AWNING TYPE WINDOWS

These windows are basically practical in the correct admission of light and proper ventilation without drafts. Sturdily built of unusually heavy special casement sections, they are positively and easily operated. Assure a high quality product incorporating features not available in any other window design.

"MAXIM-AIR" WINDOWS

This window incorporates all of the de... able features of the Donovan Awning T... Window. Lighter in construction, ... lower in cost. It is suited for u... warm climates, for enclosed porch... situations where free circulation of ... important in inclement weather as ... on sunshiny days.

DOUBLE-HUNG WINDOWS
In Two Types—Series 1380 and Series 46

Series 1380 Windows are equipped with positive action motor-spring type balances and completely weatherstripped with spring bronze. Available in single units or in integrally built twin, triple and panoramic window units all are available with or without sill ventilators.

Series 46 windows are of the counterweighted design. They are especially adapted for use in office and public buildings or where Underwriter's label of approval is required. Single or twin units may be had in either standard or special sizes and are available with or without sill ventilators.

INTERMEDIATE COMBINATION WINDOWS

Incorporates side hinged casements and projected ventilators in one design. Fabricated from specially rolled steel casement sections substantially heavier than the minimum Metal Windows Institute standard weights. The wide selection of sizes and designs add to the adaptability of the window to a wide range of architectural use.

CORNER BEADS

...ailed as an exposed concrete reinforcement. The round nose is strongly reinforced by a deep groove which holds the plaster finish for a perfect bond. It can be easily applied or nailed to any kind of wall construction without the use of clips.

METAL CASINGS

Meet a definite demand for an artistic, sanitary method of trimming around doors and windows. Afford many architectural effects. Metal casings are fire-resistive, vermin proof, easy to maintain and do not shrink or warp.

FERROBORD STEELDECK ROOFS

Truscon Ferrobord provides a fire-resistive, economical roof deck for all new construction or replacements. Covered with insulation and waterproofing, it weighs approximately 5 pounds per square foot.

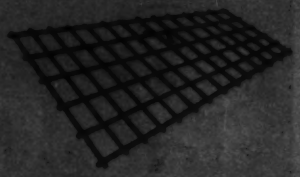
...LOODLIGHT ...TOWERS

...is a wide selection of ..., they offer a firm, ...-lasting floodlight ... for auxiliary lighting ...ting areas, etc.

CONCRETE REINFORCING BARS

A special rolled section of high grade steel, with a series of longitudinal and diagonal ribs, so designed to provide the maximum bond with the enclosing concrete.

WELDED STEEL FABRIC



Truscon Welded Steel Fabric is made in various sizes for concrete reinforcing in all types of structures. Each joint is electrically welded for permanence.

CURB BARS

...e exposed corners of concrete curbs, ..., steps, etc. Designed to give positive ...ge into the concrete. Plain surfaces ...prevent the corner without splitting ...en into two portions.

OPEN TRUSS STEEL JOISTS

Truscon developed the open truss steel joists to meet the demand for economical, light weight, fire-resistive floors in hospitals, and other light-occupancy buildings. They are easy to install. Completely shop fabricated, they reach the job ready for placing.

METAL BASE SCREED

Fabricated from light ... galvanized steel. Used principally for separating two plaster materials such as plaster walls from ..., terrazzo, or composition ..., and separating a cement waincoat from ordinary plaster. Another function is to give a permanent straight edge to which ... work.

...ARCHITECTURAL ...JECTED WINDOWS

...Attractive in appearance and convenient to operate. Provide maximum daylight, ventilation and freedom from drafts. Heavy one piece ... steel type sections in ventilators assure rigidity. Hardware is solid bronze. Screens and undersill ..., operating hardware are available for all ventilators.

METAL LATH

There is a Truscon Metal Lath for every plastering requirement. Flat lath for ceilings and sidewalls; ribbed lath for ceilings and sidewalls on concrete floors or plaster ceilings; expanded laths for stucco reinforcement; Corner Beads and Cornerite, to protect outside and inside corners.

HOLLOW PARTITION STUDS

Truscon hollow partition ... units assure maximum rigidity and economy. They are fire-resistive, provide excellent heat insulation, and sound resistance, are rodent and vermin proof. They will not swell or warp and will resist impact, vibration or plaster cracking.

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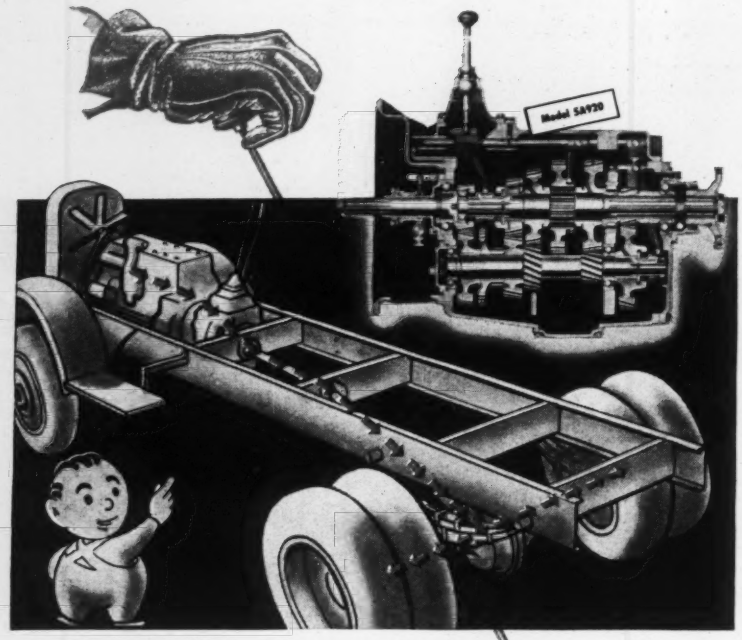

BACKBONE OF THE DRIVE LINE

When you select the *right* transmission for your rig . . . when it is *applied* to the job it was *designed* and *built* to do . . . it is the *backbone of your drive line,* giving trouble-free performance under every road and load condition . . . helping to increase profits by operating at less cost and reducing maintenance.

Fuller heavy-duty transmissions are designed and built to meet these rigid requirements . . . to be the backbone of your drive line. To reduce maintenance . . . to insure profits . . . specify a *proved-in-the-field* and geared-to-the-job Fuller Transmission.

Write for your copy of the booklet "WHY Fuller Transmissions."

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For ● Steel Plate Lining ● Steel Encasement ● Building Walls, Roofs, Facings ● Tunnel Lining ● Water Reservoir Lining ● Power Plants—Bunker Lining ● Sewer Repairs ● Tank Lining ● Canal and Ditch Lining ● Repairs of Disintegrated Concrete, Brick, Tile, Masonry

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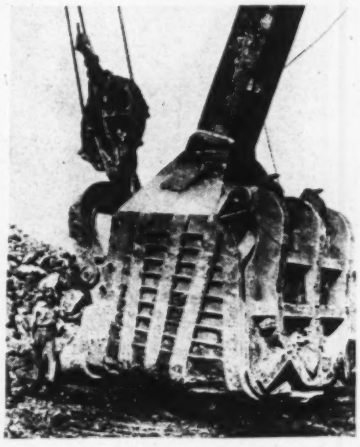
any gasoline or diesel motor, are available in all standard sizes.—*Milwaukee Lock & Mfg. Co., 730 W. Virginia St., Milwaukee 4, Wis.*

Air-Diffuser Damper — Simplified, lightweight construction of the air volume damper, a standard feature accessory of Kno-Draft high velocity air diffusers, cuts down the number of parts required. Aluminum construction throughout lessens weight and increases efficiency. The cylindrical damper is raised or lowered by turning the extended shank of the operating screw, and air volume may be quickly and easily obtained. As the damper is an integral part of the diffuser, no additional installation time is required on the job.—*W. B. Connor Engineering Corp., 114 East 32nd St., New York 16, N. Y.*



Shovel Dipper—A giant shovel dipper is capable of moving enough earth at one bite to fill a room 12 x 10 x 9 ft. On a 5561 shovel, this dipper can move the giant load two-thirds of a city block and drop it on top of a seven-story building.

Construction of the 40-yd. dipper and a newly-designed handle for it were made possible by the application of war-developed steels, which cleared the way for a dipper and handle design which is 30,000 lb. lighter than materials formerly used in achieving the same strength.—*Marion Power Shovel Co., Marion, Ohio.*

Self-Starting Synchronous Motors—The Kurman motor requires an input of only 1½ watts and produces a starting and synchronous running torque of 10 inch-ounces at 1 rpm. This great increase in torque has been accomplished without a corresponding increase in iron and copper weight. As the gears are enclosed in a

LE ROI
MILWAUKEE

AIRMASTER

. . . the symbol of unexcelled portable-compressor performance — a symbol of efficiency and dependability that saves money

Look for the compressor that carries this trademark. Watch it operate, and see why it is the greatest postwar development in portable air-compressor design. Notice that the engine speed doesn't fluctuate widely. That is Le Roi's patented, fuel-saving Econotrol* at work—it adjusts engine speed to the job demand for air. There is no rapid acceleration or deceleration — fuel economy is greater, and compressor and engine life longer. You benefit in another way, too—the Econotrol maintains higher average working pressures, enabling air tools to do more work.

Yes, you get more for your money when you buy an AIRMASTER. You not only save on fuel and maintenance, but you also receive the advantages of increased man-hour production.

AIRMASTERS are built in all mounting styles, and in sizes ranging from 60 to 500 cfm. You can select the unit best suited for your job. Furthermore, you can have famous Le Roi gasoline-engine or diesel power.

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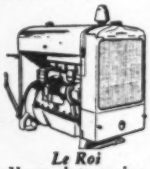
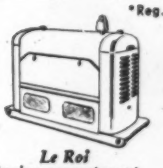
Intercooler Relief Valve • Patented Econotrol • Centralized Control Panel • Ignition Insulators • Elastic Stop Nuts • AIRMASTER Magnafluxed Valves • Traffic Reflectors • Water-cooled Manifold • Precision Fittings and Tubes.

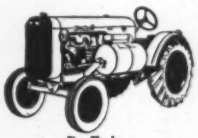
*Reg. U. S. Pat. Off.



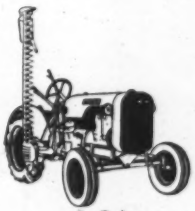
Le Roi
Heavy-duty engine



Le Roi
Engine-generator set



Le Roi
*105 Tractair**



Le Roi-
Centaur Mower

AIRMASTER — Portable Air Power at Its Best.*

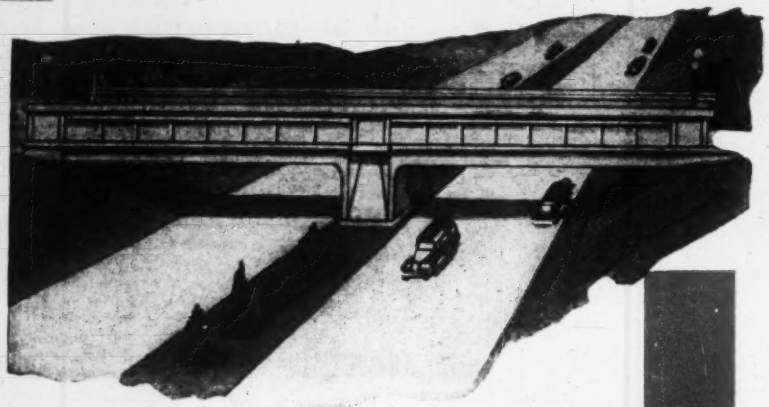
LE ROI COMPANY

MILWAUKEE 14, WISCONSIN

New York • Washington • Birmingham • Tulsa • San Francisco

C-108

WHEN BRIDGES ARE CALLED FOR



You'll find it mighty helpful to use the service facilities of your nearest AED dealer. Their shops will keep cranes, shovels, pumps, bulldozers, pavers and other bridge building equipment operating at all times.

From coast to coast, and in Canada and Mexico, the most reliable equipment distributors are joined together in a strong association known as

ASSOCIATED EQUIPMENT DISTRIBUTORS

Its members maintain proper facilities for servicing the machinery sold.

You'll find AED Members are good people with whom to deal.

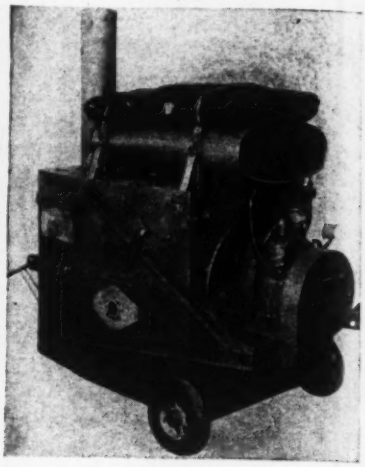
You can depend upon their integrity in any transaction.

BUY SAFELY—

BUY FROM AN AED MEMBER

ASSOCIATED EQUIPMENT DISTRIBUTORS
1928 EYE STREET, N.W.
WASHINGTON 6, D.C.

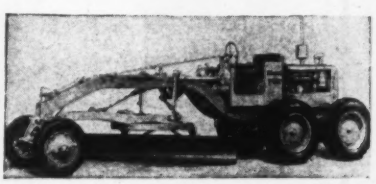
die-casting which supports the bearings and seals in the lubricant, no re-oiling is required.—*Kurman Electronics Corp., 130 Clinton St., Brooklyn, N. Y.*



Portable Heater — Self-powered heater is said to be ideal for many uses, such as pre-heating engines and other mechanical equipment; space heating temporary buildings; thawing frozen areas and machinery of all types, etc. This gasoline-burning, general utility unit weighs only 312 lb. and can be easily transported from place to place by one man. Heat output is 190,000 to 250,000 B.t.u. per hour.

The heater consists of enclosed, gravity fed combustion chamber and finned, stainless steel heat exchanger, within which fuel is burned and heat generated. Two 12-in. dia., 24-ft. waterproof, flame and heat-resistant ducts are standard equipment.—*Herman Nelson Corp., Moline, Ill.*

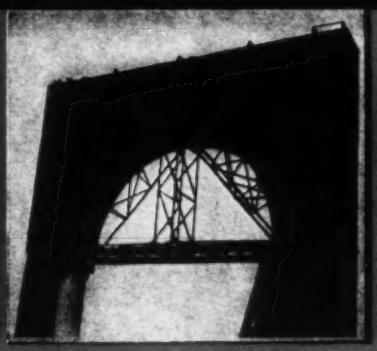
Aluminum Gasoline Engine — A lightweight aluminum engine, ¾-1 hp. weighs approximately 16 lb. It was designed especially for uses where lightweight is important, for portable and self-propelled equipment.—*Power Products Corp., Grafton, Wis.*



Motor Grader—Production of diesel No. 212 motor grader, suspended during the war, has been resumed. Powered by a rear-mounted, 35-brake h.p. four-cylinder, four-cycle engine, the grader is available in both tandem and single drives. Normally equipped with 10-ft. moldboard and leaning front wheels, it has traction, strength and blade posi-

Atlas
Labor-Saving Concrete Forms

Tunnel Forms



Bridge Pier

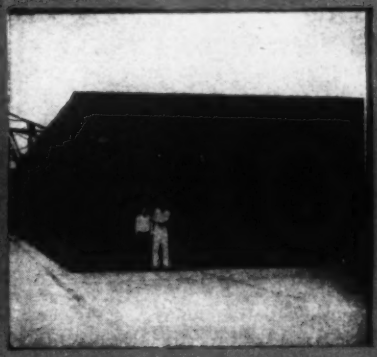
ATLAS STEEL FORMS are cutting labor costs on concrete construction 25 to 50% and more for contractors and engineers all over the country. New design in steel forms, standardization of units which are good for indefinite use without repair, advantageous use of conditions at site and other Atlas methods and processes make tremendous savings in labor and time in erection, moving and stripping of form work.

Call on us for facts and figures—layouts, labor costs, and any other data needed in connection with form work. Let us show you what Atlas Steel Forms can do for you, too.

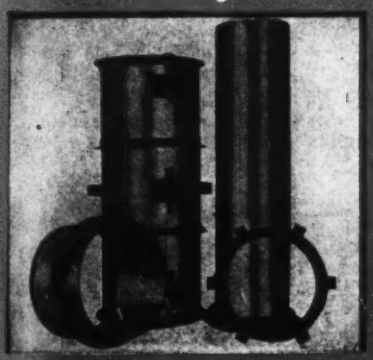
ATLAS STEEL CONSTRUCTION COMPANY
198 Strimel Street
Irvington, New York

Patented and Patents Pending

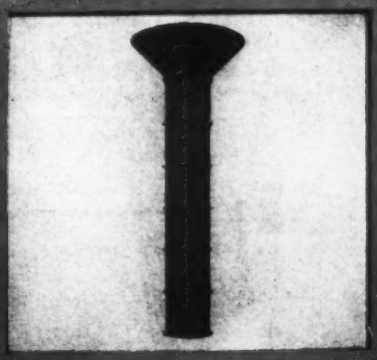
Centering



Box Caisson



Concrete Pipe



Column Forms

Sewer Forms

Flat Slab Forms

Foundation Wall

Bins and Caissons

Call Us In And Find Out What Atlas Can Do For You

MICROTOMIC
VAN DYKE
by EBERHARD
FABER

HI-DENSITY LEAD

an exclusive advantage, puts on paper a thinness of graphite; exceptionally smudge-free, BUT ACTINICALLY EXTRA-DENSE, therein is the secret of the better reproduction, so convincingly demonstrable. Something to look into! At accredited Dealers, in all principal cities.

18 degrees from 7B to 9H with Round Leads
6 degrees also with Chisel Point Leads.

tions to do a complete range of blade work. Positive-acting, precision-made mechanical power controls provide fast, easy operation of all blade and scarifier movements.—*Caterpillar Tractor Co., Peoria, Ill.*

Swivel Pipe Coupling—All-flex ball-bearing swivel pipe coupling was specifically designed to solve one of the most critical problems in the transmission of hydraulic power — conveying fluids under high pressure through pipe which swivels or rotates full 360 deg. Combination of multiple synthetic packings and metallic seals offer absolute protection against leakage at high and low pressure. Double row of ball bearings, plus metal-backed packings, give lowest possible resistance to rotation. Tests of aircraft companies and governmental agencies show torque of 2.5 in.-lb. at 1,500 psi. and 9.6 lb. at 3,000 psi. Preferably made of steel it is available in sizes from ⅛-in. to 1-in. nominal tube size with variety of threaded and elbow connections.—*Snyder Sales Corp., 5225 Wilshire Blvd., Los Angeles 36, Calif.*

Plastic Jointer — New polystrene jointer for masonry work is similar in design to standard jointer of bent iron rod used by masons as hand tool to finish off cement or mortar joints between brick and tile. Available in varying lengths, thicknesses and color, it is seven times lighter than iron jointer, easy to grasp, warm to touch, and may be readily spotted in tool kit because of its color. Its application on cement leaves no dark discoloration. Constant use smooths and tapers rod end, making it easier for mason to maintain even, uniform surface in the joints.—*Plax Corp., Hartford, Conn.*

Asbestos Packing — A V-shaped packing for steam or air rods, valve stems, boiler feed-plungers, hydraulic rams, etc., is made from woven asbestos cloth frictioned with high heat-resisting compound and molded into a V-shape. The V-shape insures automatic sealing of high or low pressure, with a minimum of surface friction on the pressure stroke and no friction on the return stroke.—*Raybestos-Manhattan, Manheim, Pa.*

Arc Welding Wires and Tapes— A group of automatic arc welding wires and tapes has been introduced, embracing five knurled type wires and five tapes, all for flat position operation and all highly recommended for low cost, uniform, automatic welding. Their applications on the production line are many. All Airco wires and tapes have had extensive laboratory tests and practical "on the job" examinations. They are manufactured in several diameters. —*Air Reduction Sales Co., Inc., 60 West 42nd St., New York 17, N. Y.*

Earth Wagon — Clamshell-bucket type bottom dump Dixson wagon can be loaded with shovels, draglines, elevating graders or any conveyor or hopper method desired and will haul any material. Bottom of buckets will open to 6x10-ft. area. Dumping operation consists of singe ½-in. cable controlled single drum power unit actuated from truck or tractor transmission. Struck measure capacity is 16.2 cu. yd. Wagon will operate with any truck or tractor of 150 hp. or more, with 10-ton rating. —*Dixson Wagon, Inc. Alhambra, Cal.*

ACCURATE, UNIFORM, DEPENDABLE
OLIVER FASTENERS

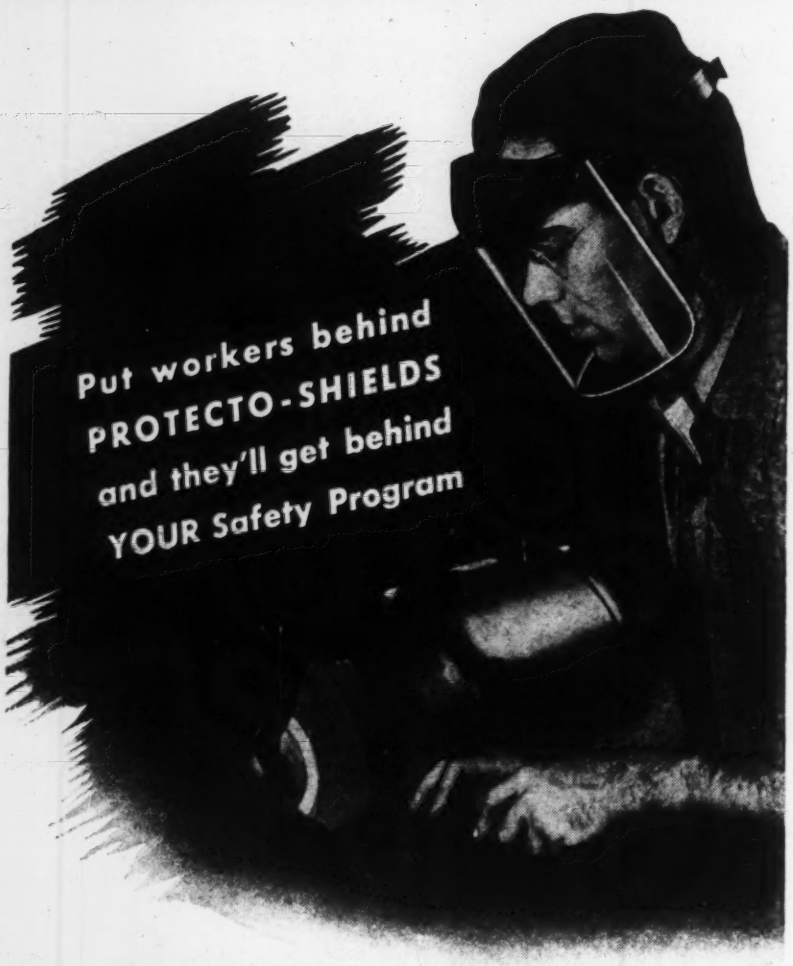
• Above is shown one aisle of our bolt-making department—with a battery of the most modern and accurate machines. In one continuous, automatic process, Oliver bolts are cold formed, trimmed and threaded from coils of steel wire. First-class workmanship and highest accuracy are maintained throughout.

To assure the uniformity, dependability and high quality of your bolts, rivets, and other fasteners—specify OLIVER!

SEE YOUR DISTRIBUTOR FOR OLIVER PRODUCTS

OLIVER
IRON AND STEEL
Corporation

SOUTH TENTH AND MURIEL STREETS • PITTSBURGH 3, PENNA.



MORE COMFORT MEANS
EASIER ENFORCEMENT OF SAFETY REGULATIONS

The more comfort in the eye protection equipment you buy—the more willingness you'll find among workers to cooperate with your eye safety program.

For light grinding, wood working, spot welding and similar light duty operations, Willson Protecto-Shield* gives adequate protection. At the same time, its light weight, its cushioned headband and full visibility permit wearing all day without fatigue.

The visor, with rigid aluminum binding, is made of clear or Willson Tru-Hue green impact resisting plastic. Slot locks hold the visor securely in place and allow easy replacement. The headband is easily adjustable for all head sizes and a tough fibre guard protects the forehead area.

When not in use, the visor tilts up and "stays put."

Protecto-Shield comes in three lengths: 8", 6" and 4". Also available with side wings for protection against chemical splash.

For help with your eye and respiratory protection problems, get in touch with your Willson distributor or write direct.

GOGGLES • RESPIRATORS • GAS MASKS • HELMETS
DOUBLE WILLSON PRODUCTS INCORPORATED
Established 1870
100 THORN STREET, READING, PA., U.S.A.

®T. M. REG. U.S. PAT. OFF.
WILLSON
TRADE MARK

Manufacturers' Activities

R. W. RENO ENGINEERING CO. has opened a steel fabricating plant in Torrance, Calif., to make steel truss joists, roof purlins and light structural steel framing. R. W. Reno and V. E. Simhauser are the principals.

INSULATED SIDING CO., Culver City, Calif., has construction under way on a $200,000 plant for production of a new siding formed of Hawaiian cane board and a product known as "brixite."

FLOYD STEVENS, former superintendent of maintenance for the Michigan State Highway Department in Berrien County, Mich., has joined the International Salt Co., Inc., as a field engineer to assist in promotion of rock salt use to keep highways free of snow and ice.

MEILI-BLUMBERG CORP., manufacturers of industrial, construction, maintenance and material handling equipment, announce the appointment of J. Frank Sims to the newly created position of sales manager. He has had many years' experience in the construction machinery industry.

D. E. MCGUIRE, assistant to the general works manager for Great Lakes Steel Corp., has been appointed chief engineer.

W. W. WYRE has been appointed district sales manager, New York City, of the Lehigh Portland Cement Co. Mr. Wyre was formerly assistant sales manager at Chicago.

CHAIN BELT CO. has materially increased its plant capacity through the purchase of the heavy ordnance plant constructed for the Defense Plant Corp. in West Milwaukee. The plant will be used for the manufacture of chain belts and some construction machinery.

H. H. LANDIS has been appointed eastern division manager of the Joyce-Cridland Co. He will work out of the Dayton, Ohio, office.

EDWARD B. HEYDEN has been named to head the construction division of the Graver Tank & Mfg. Co., Inc. Active in construction work since 1920, Mr. Heyden has been associated with The Lummus Co. for the past 14 years.

Announcement is made by OAKITE PRODUCTS, INC., New York, of the ap-

pointment of J. C. Leonard as sales manager of its industrial marketing division. He will direct the marketing and servicing activities of the industrial field staff.

ARTHUR C. WILBY has been elected vice president of United States Steel Corp. of Delaware, and will maintain his headquarters in Chicago. Mr. Wilby was appointed Chicago district manager of public relations, Carnegie-Illinois Steel Corp., Jan. 1, 1937. He also was in charge of the liquidation of surplus properties belonging to United States Steel subsidiaries as well as public relations for United States Steel subsidiaries in the Chicago district.

THE FLORIDA-GEORGIA TRACTOR CO. of Savannah and Waycross, Ga., has been appointed full line distributors of Davey compressors, according to an announcement made today by Paul H. Davey, president.

Appointment of EARL E. MORGAN as general superintendent of The Sawhill Manufacturing Co., Sharon, Pa., is announced by W. D. Reed, vice president. Mr. Morgan has been affiliated with The National Tube Co. for the past ten years and had previously been employed as an industrial engineer with the U. S. Rubber Co.

G. A. SHALLBERG, JR., has returned to the Borg-Warner Corp. as advertising manager.

RICHARD R. BASTIAN has joined the management group of Glass Fibers, Inc., Toledo, O. He recently resigned as general purchasing agent of Owens-Corning Fiberglas Corp.

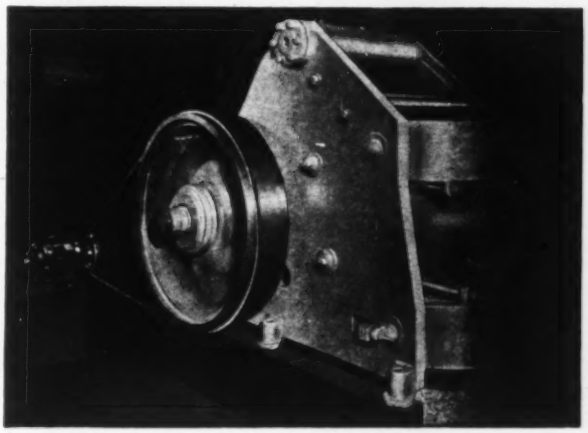
W. O. (BILL) KUPPER has been appointed manager, Middle Western sales, Ladish Drop Forge Co., with offices at 332 South Michigan Ave., Chicago, Ill. Mr. Kupper will direct the sale of the complete line of Ladish Seamless Welding fittings, forged steel fittings and forged steel flanges.

REED G. LANDIS has become vice-president in charge of sales of the Great Lakes Supply Corp., Chicago, Ill., wholesale distributors of industrial, railway and contractors' supplies.

A PACIFIC NORTHWEST LABORATORY to place research in close contact with treatment of Douglas fir and other western species was opened Nov. 1 at the Wauna, Ore. plant of the American Lumber and Treating Co., F. W. Gottschalk, Chicago, company technical director has announced. It will be in charge of William K. McFarland, chemical research engineer, who previously

POWER TO CRUSH ROCK

When you use a KUE-KEN* crusher, practically all the power is used for crushing rock. For example, a 30″x15″ KUE-KEN Simplex uses 20 to 25 HP crushing hard rock under average conditions. This crusher requires only 5 HP to start and 1½ HP to run empty! Compare this with ordinary old-style crushers. According to eminent authorities**, they require from 50 to 70% of their full load power just to run empty and should have a 125% oversize motor to start! What happens to this wasted power that you pay for? It is consumed by the useless lifting of the heavy unbalanced swing jaw, pitman and toggles, all being lifted by the eccentric, all in the same direction and at the same time. An attempt is made to correct this severe unbalance by the addition of heavy flywheels. This merely hides the destructive unbalanced forces from you and adds further load on the already overloaded bearings. No wonder bearings in the old-style burn up and wear out.



Above is shown a 30x15 KUE-KEN Simplex on the test stand. This crusher is running at 380 RPM, not bolted down. It is driven by a single vee belt to a 5 HP motor. Independent engineers reported that 1¼ HP was required to run empty and 5 HP to start. This test illustrated the smoothness and high efficiency of KUE-KEN crushers.

At present there are six sizes available—12″x6″ to 42″x25″.

We have KUE-KEN crushers set up in our plant to make crushing tests on your material. There is no obligation.

* Pronounced Q-Ken.
** Taggart's Handbook says 50-70%—Heller, 70%.

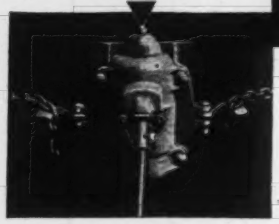
STRAUB MFG. CO., INC.

533 CHESTNUT ST.,

OAKLAND 7, CALIFORNIA

$ave TIME-MATERIALS – MONEY – Insure Better Quality with JACKSON EXTERNAL VIBRATORS

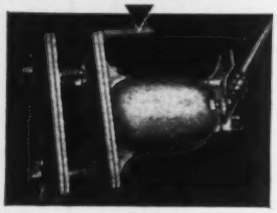
Model PTV-21A. A heavy duty unit for consolidation of concrete in Pipe Forms from 36" to 120" diameter. Model PV-4, a smaller but similar unit is designed for pipe up to 36" diameter.



IN CONCRETE PIPE MANUFACTURE

the use of a JACKSON external Vibrator will permit the use of drier, more economical mixes, greatly reduce puddling time, permit earlier stripping of forms and produce stronger concrete with a far higher degree of impermeability. Vibration is transmitted uniformly to form. Quickly attached by means of encircling chain.

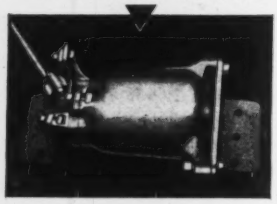
Model FV3-1 designed primarily for form vibration though applicable to many other uses.



WHERE INTERNAL VIBRATION IS IMPRACTICABLE

in such concrete construction applications as tunnel linings, or wherever sections are so heavily reinforced that internal vibration is impossible, the Model FV3-1 is literally worth its weight in gold. Quickly clamped to forms, it provides thorough vibration with all the resulting economies and higher quality of work.

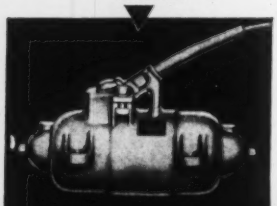
The "S" Motor shown with brackets — one of several types of fastenings available for movement of materials applications.



MOVEMENT OF MATERIALS

from or to bins, hoppers or chutes is positively facilitated by attachment of a JACKSON external vibrator designed for permanent fastening. Keeps materials in motion, eliminates waste, stoppages and time losses.

The PT-21A Motor. Similar to the "S" but more powerful. Supplied with desired fastenings for jobs requiring extra heavy vibrations.



TROUBLE-FREE OPERATION

All of the JACKSON external vibrators shown here are built around our "S" type motor and its big brother motor Model PT-21A. They are free from brushes, rings and those small parts usually responsible for trouble. They operate on 110-120 or 220 Volt, 3 phase, 60 Cycle A.C. at approximately 3600 V.P.M. 4800 V.P.M. may be had with use of frequency changers or from JACKSON Power Plants.

Write for detailed literature or recommendations for any special vibration application.

ELECTRIC TAMPER & EQUIPMENT CO.
LUDINGTON MICHIGAN

directed process control for the company's ten plants from the central technical laboratory in Chicago.

THE ATLAS MINERAL PRODUCTS Co. manufacturers of acid- and alkali-proof cements, floors, plastic linings, jointing materials and protective coatings, announces the formation of an affiliate organization, The Atlas Mineral Products Co. of Texas, Inc., Houston 1, Texas. The new affiliate includes a manufacturing plant for sulphur cements and other firm products and handles sales in the territory west of the Mississippi, except Minnesota, North Dakota and eastern Missouri, and in western Tennessee, Mississippi and Louisiana.

GENERAL PANEL CORP. of New York has entered into an agreement with Celotex Corp. for West Coast distribution of General Panel houses. Under license from General Panel of New York, the California corporation has launched a $22,000,000 building program for the Pacific coast. Production schedule calls for 10,000 four-room houses for West Coast distribution alone during 1947.

H. J. HOCKER, former chief of production for Chicago Engineer Procurement district, has been appointed general plant manager of the C. R. Jahn Co., Chicago, Ill., manufacturers of heavy-duty low-bed trailers.

GARDNER-DENVER CO. announce the promotion of B. P. Spann, formerly advertising manager, to personnel and industrial relations director. Mr. Spann will be in charge of all factory and office personnel for the Quincy plant. The new advertising manager is D. P. Tunnicliff.

Continuing current nationwide expansion of its sales division, INDEPENDENT PNEUMATIC TOOL CO., Chicago, Ill., manufacturer of Thor portable pneumatic and electric tools, announced the appointment of J. A. Hill, formerly manager of its New York branch office, as manager of electric tool sales, and the opening of a new branch office in Cincinnati at 426-428 Elm St.

FLEXIBLE STEEL LACING CO., Chicago, Ill., manufacturers of Alligator, Flexco HD and Flex V belt fasteners and Alligator belt cutters, has appointed James Gillespie as sales representative for Texas, Oklahoma, Arkansas and Louisiana. He has taken over the job handled by his father, the late J. W. Gillespie.

GEORGE W. WARWICK has been appointed chief engineer of foreign operations of the Armstrong Cork Co.'s foreign subsidiaries, company officials have announced.

Aluminum Company of America
Pittsburgh 19, Pa.
Re: Tentative Specification for Ready-Mixed Aluminum Paint
In response to requests from Municipal, County and State Highway Departments, we have prepared the accompanying specifications describing one type of ready-mixed aluminum paint suitable for bridge painting.
Properly formulated paints that meet the requirements of this specification should prove to be superior in many ways to aluminum paints mixed on the job. For example, it is difficult for a painting crew to duplicate in the field the compounding skill and efficient equipment of the paint manufacturer. Buying the finished paint means a more uniform product, better dispersed pigment and lessened danger of contamination or adulteration. An aluminum paint of this type is also more convenient for the painter, saves expensive mixing time and reduces material losses to a minimum.
In developing this specification, use was made of Federal Specifications and ASTM methods of tests where applicable. For example, the type of vehicle adopted for this work has proved its reliability over many years of practical use. Similarly, the pigment, Standard Aluminum Paste has been used successfully for more than 10 years on bridges.
These specifications are tentative and will, no doubt be improved upon by suggestions from Testing Laboratories, Bridge Engineers and Paint Manufacturers.
ALUMINUM COMPANY OF AMERICA
Data that may help you . . .
GET MAXIMUM PROTECTION AND ECONOMY FROM READY MIXED ALUMINUM PAINTS

If you are one of those who must buy on specification only, this "Tentative Specification for Ready Mixed Aluminum Paints" may guide you to new economies. As its preface states, "Properly formulated paints that meet the requirement of this specification should prove superior in many ways to aluminum paint mixed on the job . . . it is difficult to duplicate in the field the compounding skill and efficient equipment of the paint manufacturer . . . more uniform . . . better dispersed pigment . . . less adulteration. Also . . . more convenient, saves mixing time, reduces material losses . . ."

This is not an effort to change your mind if you are an advocate of job-mixed aluminum paints. But it presents an opportunity to take advantage of recent improvements in pigment and vehicles. Either way, Alcoa Albron pigment, made of aluminum more than 99% pure, assures painting satisfaction. ALUMINUM COMPANY OF AMERICA, 1812 Gulf Building, Pittsburgh 19, Pennsylvania.

ALCOA ALBRON PASTE

ALCOA

Having Research *Problems?*

Southern New England's leadership in research is acknowledged all over the country

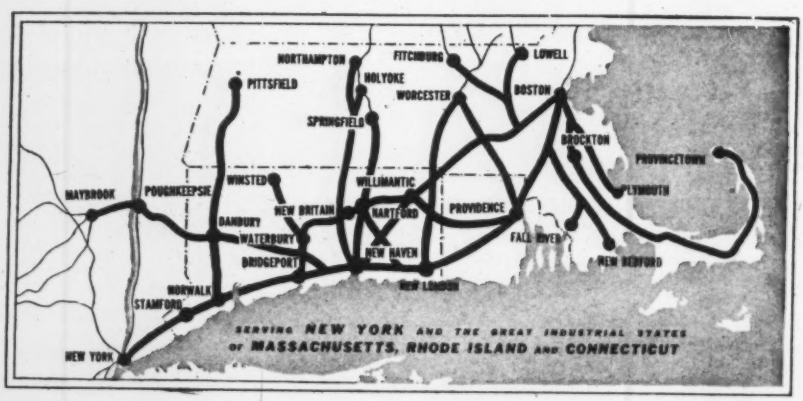
If the future success of your business depends on hot-from-the-test-tube information, you'll find it at your finger tips in Southern New England.

One-seventh of *all* the Nation's research laboratories are located in Massachusetts, Rhode Island and Connecticut—among them, the highly important industrial and medical research departments of some of America's outstanding educational institutions.

Being "next door" to world-famous research facilities is just one of the many benefits that accrue to industry in Southern New England. For a complete resume of all the advantages available for your new plant, write for the new booklet, "SOUTHERN NEW ENGLAND FOR TOMORROW'S INDUSTRY."

Address: P. E. Benjamin, Mgr., Industrial Development, New Haven Railroad, Room 201H, 80 Federal Street, Boston 10, Massachusetts.

THE NEW HAVEN R. R.



Manufacturers' Publications

"How To Pour Bearings"—This is the title of a two-color illustrated wall card recently published by *Joseph T. Ryerson and Son, Inc.*, steel distributors and manufacturers of Glyco babbitt metals. With a series of six cartoon type pictures the steps necessary to secure good, tightly lined bearings are made clear and easy to follow. The instructions are printed on card stock suitable for hanging in the shop. Copies of the card may be secured by writing to Ryerson at any of its plants at Chicago, New York, Boston, Philadelphia, Buffalo, Pittsburgh, Cleveland, Cincinnati, Detroit, Milwaukee, St. Louis and Los Angeles.

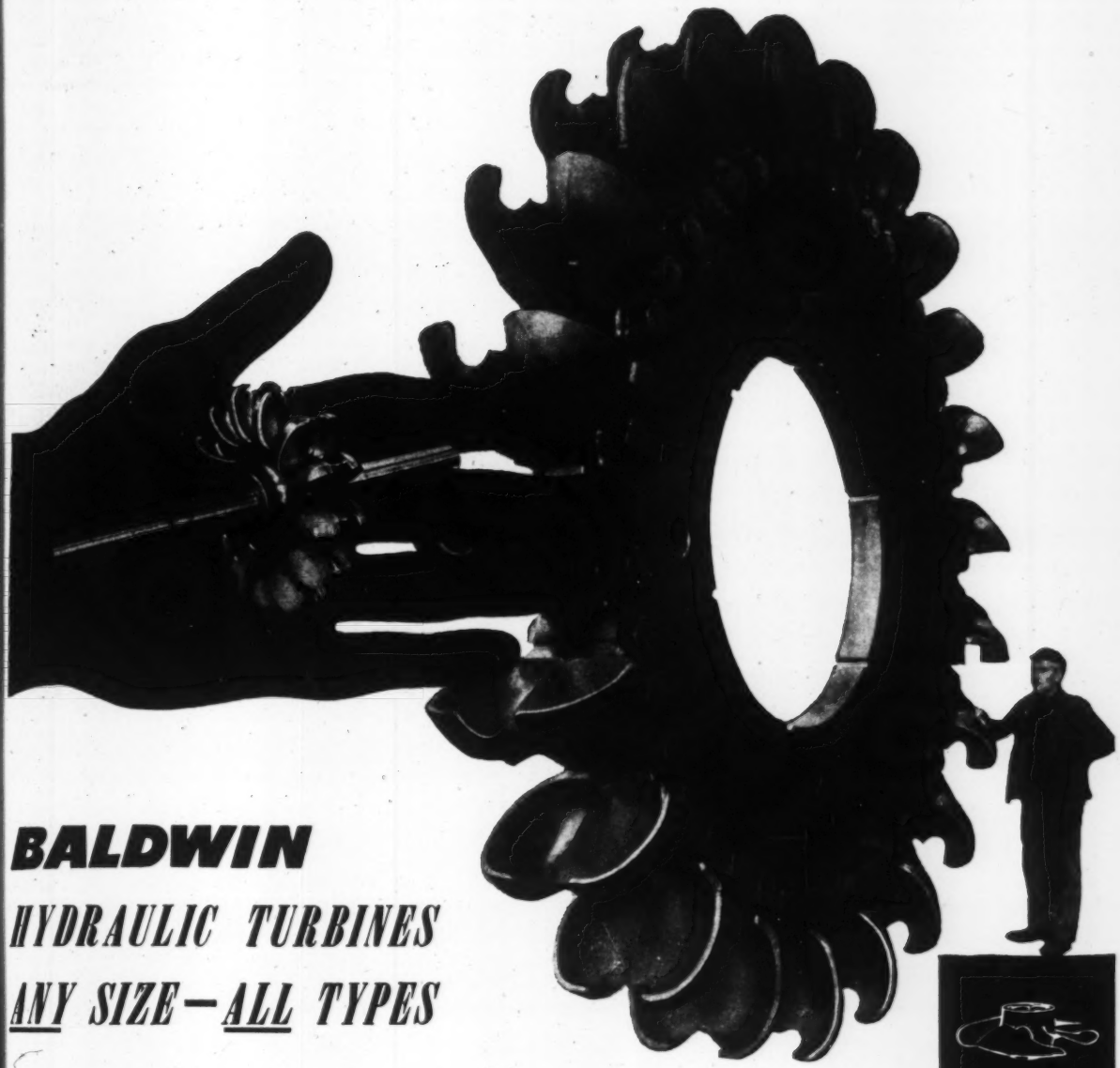
Preformed Wire Rope — (28-p., three-color booklet) Tells story of development of preformed wire rope and what that development has meant to industry. In non-technical language it tells what preforming process does to wires in rope and what effect it has on rope's final service.—*Preformed Wire Rope Information Bureau, 520 N. Michigan Ave., Chicago 11, Ill.*

Shovel, Crane and Dragline—(20-p. bulletin) Describes Type 802 unit, featuring application of Precision air control. It includes specifications, capacities, working ranges and illustrations showing details of construction. This model has 2-cu. yd. capacity as shovel, 40 tons as crane, and variable as dragline.—*Lima Locomotive Works, Inc., Shovel & Crane Division, Lima, Ohio.*

Turbo-Blowers — (16-p. booklet) Fully explains turbo-blowers, rotary compressors and vacuum pumps. Designed for student training, it shows simple construction of turbo-blower and reproduces curves depicting pressure volume, influence of water vapor on volume and correction curves for volumes to maintain constant air weight with changes in temperature and barometric pressure.—*Allis-Chalmers Mfg. Co., 677, Milwaukee 1, Wis.*

Induction Motor—(12-p. bulletin) Covers Type OG (protected type) standard squirrel cage induction motor. It includes construction, features, and typical applications.—*Louis Allis Co., Milwaukee 7, Wis.*

Concrete Vibrators—(12-p. catalog) Describes design, construction and efficiency of gasoline and electrically oper-



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ANY SIZE—ALL TYPES

WHERE HEADS ARE HIGH

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There's no better example of how completely the Baldwin line of turbines meets every need, than the Pelton (Impulse type) turbine. Sizes range from a runner that can be held in the hand, up to any diameter permitted by transportation facilities.

Baldwin Pelton Turbines are recommended for high heads, abrasive water conditions, or low-head, small horsepower installations. A Baldwin Pelton turbine is operating under the highest head in the western hemisphere for this type . . . 2562 feet.

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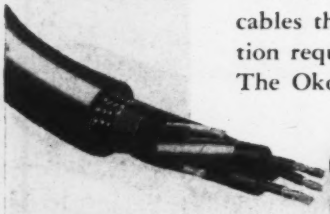
OUTDOOR POWER LEAD PROBLEM SOLVED

by OKONITE-ENGINEERED CABLE

A recent article in "Electrical West" told how Pacific Gas and Electric Company solved a specific mobile substation problem by the use of Okonite's high voltage portable cable for the emergency power leads. This installation, it was reported, "greatly added to the versatility and usefulness of the substation."

Okonite-engineered portable power cables are selected for mobile substation power leads because they have durability and flexibility in outdoor service — the combination that makes them so widely used on shovels and dredges.

Write for further information about a line of cables that meet and excel all IPCEA specification requirements for shovel and dredge cables. The Okonite Company, Passaic, New Jersey.



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ated high-speed vibrators, surfacing attachments and tools for all concrete work. It also contains condensed outline and illustrations of other equipment made by company.—*Master Vibrator Co., 200 Davis Ave., Dayton 1, Ohio.*

Color Harmony—(Illustrated, multicolor brochure) Presents "eye comfort" plan of harmonious color series, designed to improve visibility, relieve eyestrain and promote health, safety and morale in industrial plants and institutions. Samples are given of four series of colors — designated as day light, warm light, cool light, and soft light—for use on walls and ceilings and as trim, dado and base.—*Truscon Laboratories, Inc., Detroit 11, Mich.*

Diesel Power—(16-p. booklet) Pictures wide variety of uses of diesel power.—*Caterpillar Tractor Co., Peoria 8, Ill.*

Protective Coating Comparison Chart—(8-p. technical bulletin) Gives complete factual information in condensed form about the entire Amercoat line. Specific applications are recommended for solving individual problems in public works, sewage and water works industries. Chart shows all characteristics and properties of plastic coatings and is a ready guide for selecting proper coating, preparation of surface, and application methods on steel, concrete and wood. In addition, cost per square foot for materials, with area formulas, is provided.—*Amercoat Division, American Pipe & Construction Co., P.O. Box 3428, Terminal Annex, Los Angeles 54, Calif.*

Suction Hose — (Catalog section) Features description of Spiralock construction which provides smooth-bore, lightweight and easy-to-bend hose. It is recommended for any degree of suction and for discharge pressures up to 30 psi. Other types of suction hose are also pictured and described.—*The B. F. Goodrich Co., Akron, Ohio.*

Concrete Guns — (16-p. bulletin) Features three newly improved CMC Jet Crete Gun models. It shows typical on-the-job applications and tells how pneumatically applied concrete can now be used to build, protect, or repair with speed and economy.—*Construction Machinery Co., Waterloo, Iowa.*

Graders and Rollers—(Three catalogs) Catalog No. 290 describes 102 heavy-duty motor graders. No. 288 covers 402 light-duty motor grader, de-

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K&M "Century" ASBESTOS CORRUGATED

If you are planning repairs, remodeling, or new construction, the choice of building materials is all-important to you. Here are six compelling reasons why K&M "Century" Asbestos Corrugated has proved to be the ideal industrial siding and roofing material:

1. Corrosion-proof . . . "Century" Corrugated resists the effects of rust, corrosion, smoke, soot, moisture, oil, other conditions so destructive to ordinary building products.

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3. Fire-resistant . . . it *cannot* burn, and it helps prevent spread of fire.

4. Speedily installed . . . large easy-to-work unit sizes speed construction, hold labor costs to rock-bottom.

5. Extremely strong . . . corrugations build *extra* structural strength into rugged asbestos-cement composition. It actually grows tougher with age.

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It will pay you to send for full descriptive matter on "Century" Asbestos Corrugated and Flat Lumber. Just write us, we'll put it in the mail at once.

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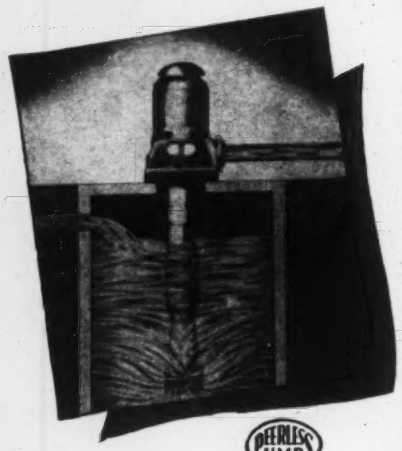

FULL TURBINE PUMP UTILITY & CAPACITY

from Short or Medium Settings

Peerless Vertical, Close-Coupled Turbine Pumps offer a most efficient method of supplying and moving water from short settings. Ideal for installation over sumps, pits, basins, etc., where turbine pump utility and capacity are required. Capacities: From 15 to 30,000 G.P.M. For medium and high heads • Oil or water lubrication • Choice of Drives.

Peerless Vertical, Close-Coupled Pump applications include—boosting; recirculation; reservoir pumping; redistributing; settling and clarification; air conditioning; chemical processing; water cooling; mine dewatering; cooling tower.

Request Bulletin B-159, describing the engineering, construction and application of Peerless Vertical Close-Coupled Turbine Pumps.

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signed for economical light construction and ordinary maintenance work. No. 295 tells about portable roller, which is said to have the compression effectiveness of a conventional 5- to 7-ton tandem roller and with the added advantage of quick and easy towing by a truck from job to job.—*Galion Iron Works & Mfg. Co., Galion, Ohio.*

Road Book—(54-p. book, seventh edition) furnishes useful tables and information on use of Tarvia and Tarvialithic for highway engineers and contractors. — *Barrett Division, Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y.*

Portable Water Units—(8-p. pamphlet) Describes Filt-R-Stil units and their use in demineralization of highly brackish waters. It includes operating data on typical successful application of equipment in supplying water needs of entire community and lists specifications on standard models available. Mechanical and chemical theories involved are explained with aid of schematic drawings and flow diagrams. Operation is described as comparable to simple cold filtration with company's Ionac ion-exchange resins acting as filtering media.—*American Cyanamid Co., Ion Exchange Products Department, 30 Rockefeller Plaza, New York 20, N. Y.*

Zoned Equipment—(16-p. instructional booklet) Defines basic zones recognized in modern problems of earthmoving and outlines types of equipment suitable to each. Delineation of zones in which power equipment, slow-speed hauling equipment and high-speed hauling equipment are utilized for maximum productivity provides theme. How company's products meet these zone requirements and adapt themselves to in-between cases is shown.—*Caterpillar Tractor Co., Peoria 8, Ill.*

Rubber Products — (Pictorial bulletin) "The Manhattan Story in the Construction Industry" is told with interesting installation photographs showing belting and hose on important construction projects, including Delaware Aqueduct, George Washington Bridge, New York West Side Elevated Highway, Mississippi River Bridge at New Orleans, Norris Dam, New York's Triborough Bridge, Wanaque Reservoir Dam, and Santee-Cooper Dam.—*Raybestos-Manhattan, Inc., Manhattan Rubber Division, Passaic, N. J.*

Brick and Tile Masonry—(16-p. folder) Outlines future open to young men in the masonry craft.—*Structural Clay Products Institute, 1756 K St., N.W., Washington 6, D. C.*

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We always figured in our shop that if we built engineering instruments *good enough*, they would be used around the world. Here are two Leupold products that are popular—maybe you need one or both of them:

LEUPOLD HAND LEVEL

Light. Durable. Compact. Designed so that you can adjust permanently the magnification of the bubble to each individual eye. Finished in crystal grey with black trim. 5¼ in. long—¾ in. diameter. Comes in a leather case.

LEUPOLD ABNEY LEVEL
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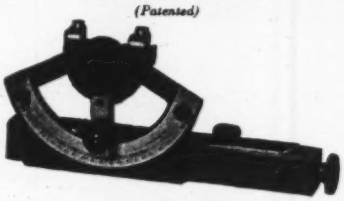

Designed to change readily from one graduation to another without reversing the frame; also to adjust permanently the magnification of the bubble to each individual eye . . . 6½ in. long — radius of arc 1¾ in. Furnished with leather case.

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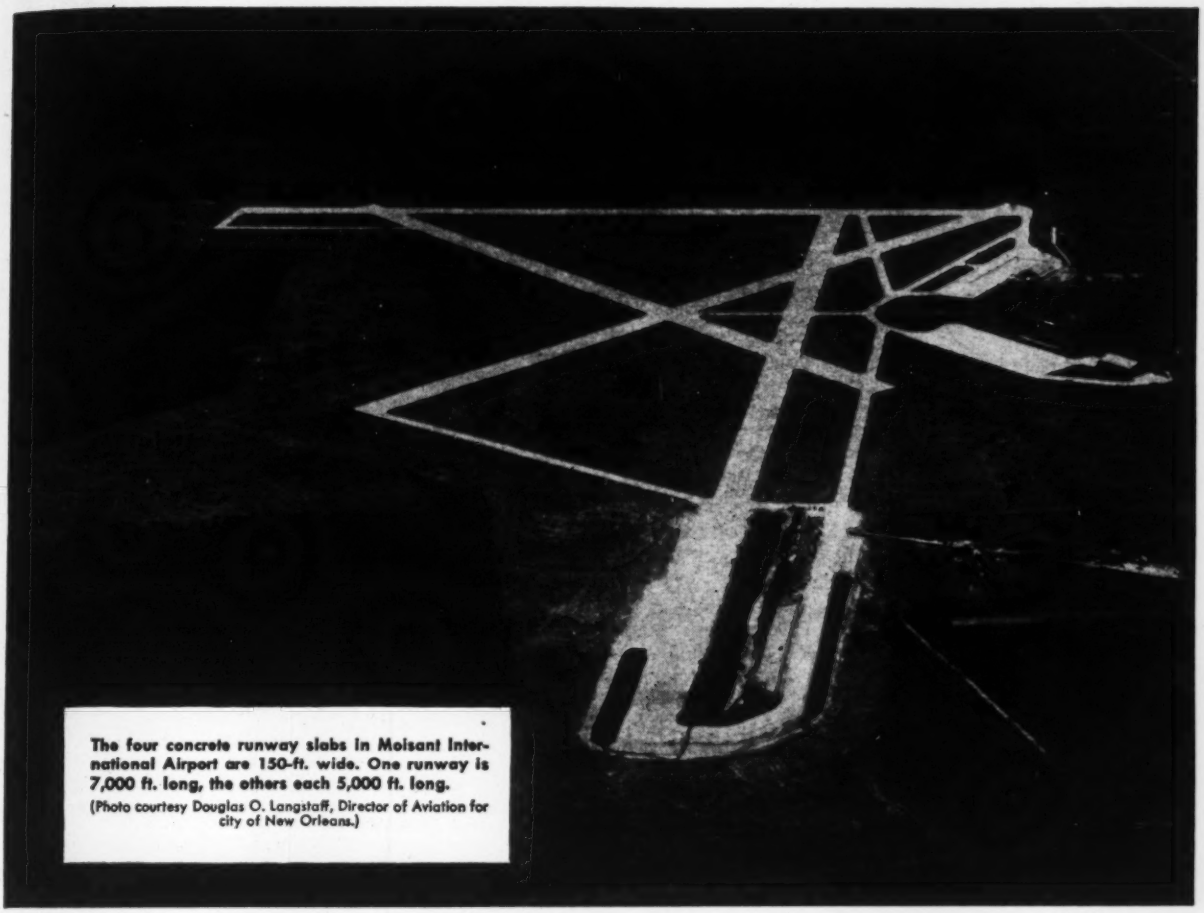

The four concrete runway slabs in Moisant International Airport are 150-ft. wide. One runway is 7,000 ft. long, the others each 5,000 ft. long.
(Photo courtesy Douglas O. Langstaff, Director of Aviation for city of New Orleans.)

CONCRETE RUNWAYS

for Safe and Economical Airline Operations

With the heart of the airport—four portland cement concrete runways—completed, New Orleans, La. has announced the opening of its Moisant International Airport for commercial operations. Administration building and hangars are still to be built.

Concrete airport runways like these usually cost less to build than any other pavement of equal load-carrying capacity. When correctly designed they provide ample strength, are economical to maintain and give years of safe, uninterrupted all-weather operation without costly rebuilding.

The low first cost of concrete, its low maintenance expense and long service life—give *low annual cost*—the true measure of airport pavement economy.

And besides economic superiority, concrete runways have these added advantages:

- **High visibility day or night**
- **Low crown for rapid drainage**
- **High skid resistance**
- **No loose particles to damage planes**

Our technical staff will gladly assist engineers in determining the most economical concrete pavement design for any condition of load or service.

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High-Speed Internal *Viber-ation* improves all types of concrete construction. Vibers give you the unmatched speed of **9,500RPM, *in concrete.*** Get better workmanship and dependable service with Vibers —they're built to "take it." All Viber units are interchangeable for minimum investment and greatest range of work. Three types of power; Electric, Air, Gasoline. Send for your copy of the Viber Catalog.

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Elections and Activities

W. G. Hoyt, executive officer, Water Resources Committee, Department of Interior, has been elected president of the District of Columbia Section of the American Society of Civil Engineers. He succeeds Frank L. Weaver, Associate Chief of the Bureau of Water Power of the Federal Power Commission. C. D. Curtiss, Deputy Commissioner of the Public Roads Administration of the Federal Works Agency, was named vice-president, succeeding Mr. Hoyt. Charles J. Stevens of the construction department of the Navy's Bureau of Yards and Docks, will continue for another year as secretary of the section. The present treasurer, A. L. Cochran, of the Office of the Chief of Engineers, War Department, was also reelected.

J. A. English of Salisbury was elected president of the North Carolina section of the American Water Works Association at its 26th annual joint convention with the North Carolina Sewage Works Association at Raleigh, N. C., recently. He succeeds L. I. Lassiter of Wilmington. W. M. Franklin of Charlotte was elected vice-chairman; George S. Moore of Albemarle was reelected secretary-treasurer; and J. M. Jarrett of Raleigh was named trustee. E. M. Johnson of Raleigh was selected chairman of the nominating committee.

Officers of the Pittsburgh, Pa., branch of the Society of American Military Engineers are: President, Col. W. E. Lorence; vice-president, Maj. Joseph W. Carlson; secretary-treasurer, Robert D. Packard.

Officers elected at the recent annual meeting of the Illinois Association of County Superintendents of Highway, were: President, Joseph R. Fay, Hancock County superintendent, Carthage; vice-president, H. A. Kluge, Madison County superintendent, Edwardsville, secretary-treasurer, Frank Adair, Adams County superintendent, Quincy. Outgoing president was Charles L. Dees, Crawford County superintendent, Robinson, Ill.

The Carolinas Branch of the Associated General Contractors has elected officers as follows: C. Y. Thompson, Greenwood, S. C., president; Robert H. Pinnix, Gastonia, N. C., vice-president; C. P. Street, Charlotte, N. C., treasurer; and directors: C. P. Ballenger,

TESTED AND PROVED IN THE FIELD!

3 TYPES DESIGNED FOR EVERY DIGGING CONDITION

LS . . . A lighter weight bucket designed for levee and drainage work.

TS . . . A medium weight bucket, classified as a general purpose bucket.

HS . . . A heavy duty bucket for moving shale or any hard formation.

3/8 to 30 Cubic Yds.

HENDRIX *Lightweight* **DRAGLINE BUCKETS**

Write for descriptive literature—
or ask your dealer.

You automatically step up the YARDAGE of your dragline by hooking up a Hendrix Lightweight Bucket! It's 20% to 40% lighter than other buckets, type for type! Can be used on a machine designed for small operations and still maintain the allowable loaded weight. You'll get bigger payloads on operations requiring a long boom, and in wet digging you'll increase your payloads by leaving the water in the pit. We took the load ***out of the bucket***... to let you put it ***inside!***

- ★ 20% to 40% lighter than other buckets, type for type.
- ★ All welded construction for greater strength and durability.
- ★ Manganese Steel chains, fittings, and reversible tooth points.
- ★ Full Pay Load every trip, even in wet diggings.
- ★ Perfect Balance; handles easier, fills faster, dumps cleaner.
- ★ Three Types; light, medium, and heavy duty. With or without perforations.

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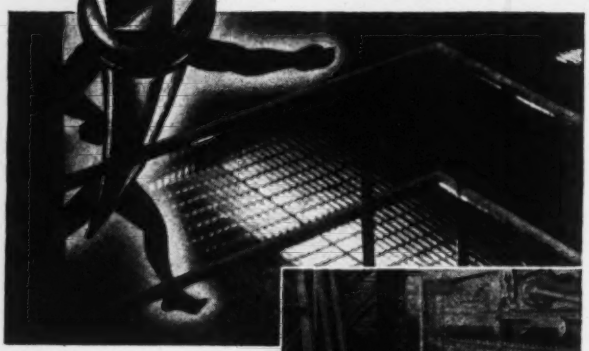
for better open steel flooring and stair treads



The glow from the open furnace door below the grating illustrates the maximum light, ventilation and the ease of maintenance that goes with BATES • GRATES. Normal cleaning routine keeps the floors in new-floor condition — clean and safe.

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Up the stairs or along the walkways, BATES • GRATES are safer, stronger, more durable.

THESE are the features you want in open steel flooring and stair treads: Strength, safety, ease of maintenance, durability, good underfloor lighting and maximum ventilation.

You get all six to the limit when you install BATES • GRATES. The simple directness of BATES • GRATES engineering — with Hex cross bars fillet-welded to main bars — makes this possible.

You don't pay for BATES • GRATES quality . . . It pays you.

Jr., Greenville, S. C.; H. L. Coble, Greensboro, N. C.; N. K. Dickerson, Jr., Monroe, N. C.; A. J. Fox, Raleigh, N. C., Eugene Skinner, Charleston, S. C. and Ernest Spong, Columbia, S. C.

At the fall meeting of the Arizona Sewage and Water Works Association resolutions were passed urging adequate legislation to provide a code for ground water conservation, and for the continuance of the study of mutual problems confronting sanitary engineers along the border of the United States and Mexico.

A chapter of the National Association of Home Builders of the U. S. A. has been organized in Wilmington, Del., with these officers: A. J. Vilone, president; A. L. McCabe, vice-president; Francis E. B. McCann, secretary, and Frank Collins, member of the national board. On the executive committee are: Joseph Johnson, chairman; Bernard McGovern and A. Fortunato.

Engineering School News

In an effort to keep North Carolina-trained engineers at work in the state, Dean J. H. Lampe, of the North Carolina State College School of Engineering, has mailed letters to more than 500 of the state's industries inviting immediate interviews with prospective graduates. At present there is an inadequate number of trained engineers in the state's industries and there has been a tendency of engineers to migrate to other states.

Designed to function as a service department to the existing engineering departments, a department of theoretical and applied mechanics will be established at Lafayette College. The new division will offer all courses in mechanics now taught by several engineering departments, and certain of its courses will be on an elective or required basis for students majoring in physics and mathematics.

Election of the Harvard University graduate school of engineering and the Rhode Island State College Engineering experiment station to active membership in the Engineering College Research Association has been announced. This brings the active membership of the association to 71, according to Dean F. M. Dawson of the State University of

CLAY PIPE DRAINS 200-ACRE MODEL OF MISSISSIPPI WATERSHED

This Mississippi watershed project is being carried out by order of the Chief of Engineers, U. S. Army, by the engineers of the U. S. Waterways Experiment Station, operating under the supervision of the Mississippi Commission, Vicksburg, Miss.

U. S. Army engineers are using 54,000 feet of Vitrified Clay Pipe in constructing the large drainage system of the elaborate 200-acre scale model of the Mississippi Valley shown above. This model is being built to study flood control methods in the 1,244,000 square miles of the Mississippi watershed. Engineers found drainage absolutely vital to this huge scale model for two reasons: (1) the necessity for carrying off torrential rainfalls, (2) for removing water pumped into the replica to simulate flood conditions. The entire model, representing 41 per cent of the total area of the United States, will require 3 to 5 years to complete. Actual operation will be initiated as soon as a sizable section of the model is ready.

HERE IS AN EXAMPLE OF EXPERT CONSTRUCTION!

Note the narrow trenching up to the top level of the pipe . . . die-straight, accurate alignment . . . control of trench width . . . carefully-made joints. Here's a job that has been carefully engineered and carefully installed for the very best results.

ON ANY PROJECT, combine engineering "know how" with Clay Pipe, and you have an unbeatable combination for long, trouble-free service! Clay, nature's raw material, is shaped under tremendous pressure and vitrified at fusing temperatures to produce the tough, hard pipe that never wears out. Clay Pipe is impervious to acids, corrosion, crumbling and rust. It does not require periodic or frequent replacement. *When you use clay, it's down to stay!*

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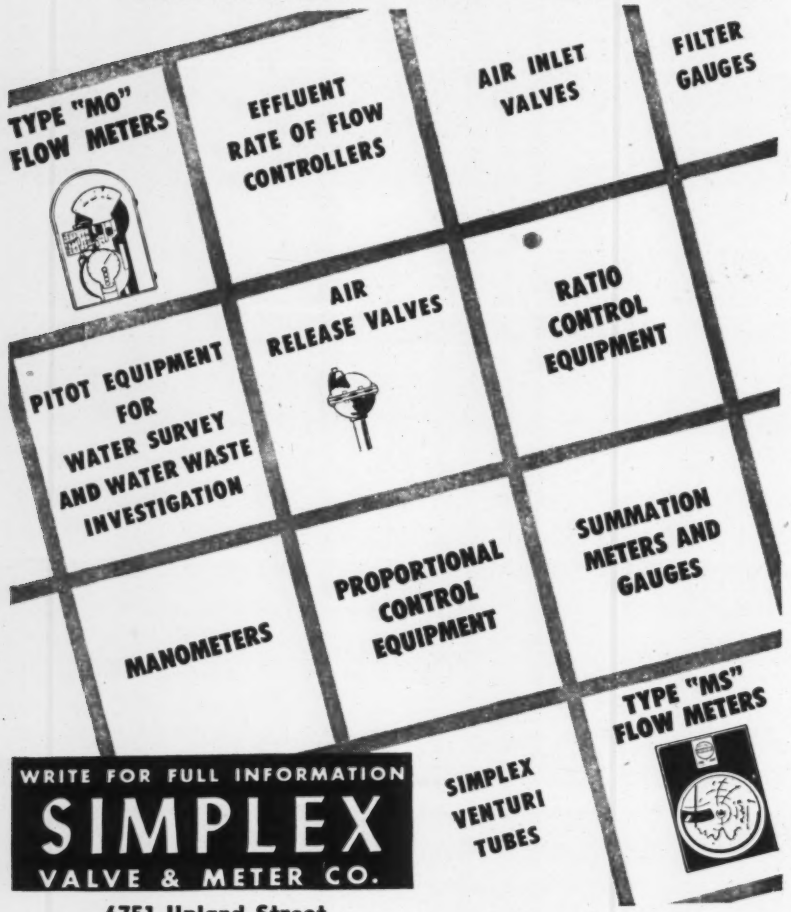

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BOSTON • CINCINNATI • NEW ORLEANS

Iowa, who is association president.

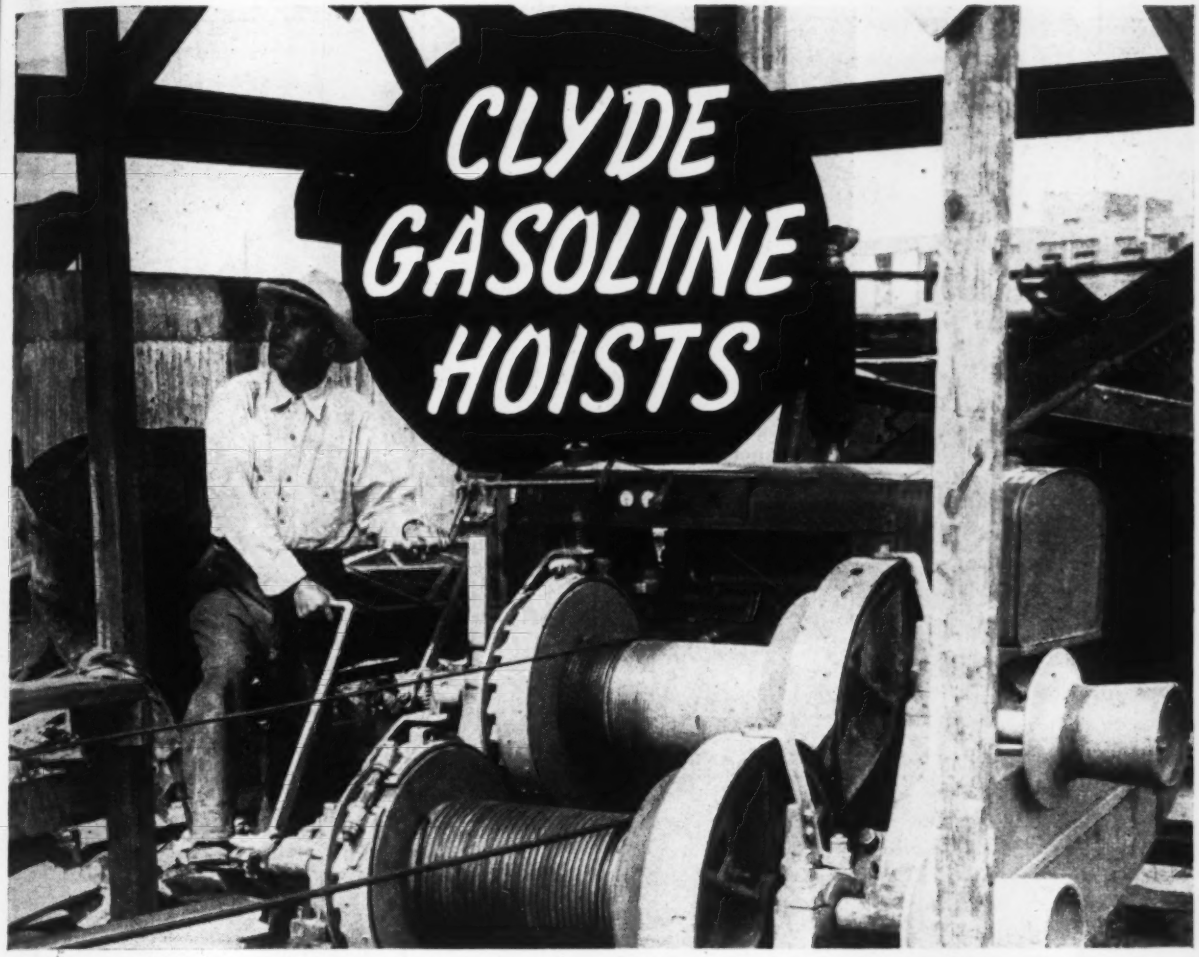
The largest number of Master of Science degrees ever conferred by the graduate school of Stevens Institute of Technology were awarded during the last academic year, it was reported in the 16th annual report of the school. A 14.8 percent increase in enrollment from 373 in 1944–45 to 428 in 1945–46 was also reported. Ninety-nine American colleges and four foreign institutions were represented by students in the graduate school.

Georgia School of Technology has started a 12-weeks course with three lectures a week for students not interested in specific training in industrial hygiene and sanitary engineering as a profession, but who would like some knowledge of this field. The course is open to all engineering students and the lectures are by George W. Reid, associate professor of sanitary engineering and industrial hygiene, assisted by V. N. Hendrick, of the Georgia State Department of Health. There are 70 students enrolled. Georgia Tech has also announced a program of graduate study in safety engineering.

The Commission on Higher Education of the Middle States Association of Colleges and Secondary Schools recently completed a survey of the library, laboratories, buildings, entrance requirements, and curricula of The Cooper Union, N. Y. City. The vote of acceptance which followed gives The Cooper Union accredited standing among members of the American Association of Universities and Colleges.

Day and evening courses come within the association's accreditation. The institution is already accredited by the Regents of the State of New York, and degrees granted by the school of engineering are accredited by the Engineers' Council for Professional Development.

Cornelius W. Kruse has accepted appointment as associate professor of sanitary engineering at the Johns Hopkins School of Hygiene and Public Health. He recently completed 9 years of service with the Tennessee Valley Authority where he served as resident engineer on the Pickwick, Wilson, and Kentucky projects in connection with general environmental sanitation activities. Mr. Kruse received his B. S. in civil engineering from the Missouri University School of Mines and Metallurgy in 1934 and the degree of civil engineer from the same institution in 1937. In 1940, he was awarded his master's degree in sanitary engineering at Harvard University. In 1945, he continued his study at Johns Hopkins.



Clyde Gasoline Hoists on your job assure better building schedules . . . materials and supplies will be handled rapidly and economically with less danger of costly shut-downs.

Clyde Hoists are quality hoists all the way through . . . they are scientifically engineered for easy operation and efficient service. The best quality materials obtainable; careful and accurate workmanship combine to make them safe, dependable and long-lasting.

The illustration above shows the construction of the Famous-Barr Relay Station in St. Louis, Mo. Erection work is being done by the Westlake Construction Company. Mr. Les White is general superintendent for this company.

The concrete work, building forms and pouring concrete, was sub-contracted by H. A. Dailey, Inc. with Mr. Earl Hodson as job superintendent. H. A. Dailey, Inc. purchased two Clyde Gasoline Hoists to help speed-up building schedules.

On your next job, check the advantages of Clyde Equipment. Write for special bulletins on any Clyde item.

HOISTS . . . DERRICKS . . . WHIRLEYS . . . CAR PULLERS . . . HAND POWERS
BUILDERS TOWERS . . . DECK MACHINERY . . . TANDEM ROLLERS . . . LOGGING EQUIP.

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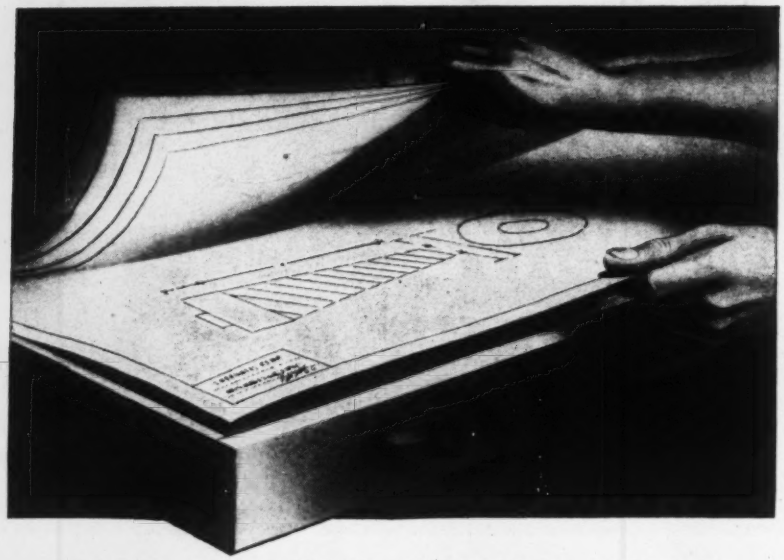

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Reports and Pamphlets

(*Continued from page* 128)

AMERICAN ROAD BUILDERS' ASSOCIATION—WHAT IT IS—WHAT IT DOES. American Road Builders' Association, International Building, 1319 F. St., N. W. Washington 4, D. C.

STEPS AN AIRPORT SPONSOR MUST TAKE TO PARTICIPATE IN THE FEDERAL-AID AIRPORT PROGRAM—Bulletin No. 114. American Road Builders' Assoc.

A MESSAGE TO MUNICIPAL OFFICIALS—PLANNING AND CONSTRUCTION OF STATE AND MUNICIPAL PUBLIC WORKS—Bulletin No. 105. American Road Builders' Assoc.

SOIL TESTS FOR MILITARY CONSTRUCTION—Bulletin No. 107. American Road Builders' Assoc.

SURFACE WATER SUPPLY OF THE UNITED STATES—PART 5—HUDSON BAY AND UPPER MISSISSIPPI RIVER BASINS—Geological Survey Water-Supply Paper 1005. For Sale by the Superintendent of Documents, Washington 25, D. C. 70c.

AN ANALYSIS OF TAXATION FOR HIGHWAY PURPOSES IN CALIFORNIA—1895-1946—By R. M. Zettel. Joint Fact-Finding Committee of the California Legislature on Highways, Streets and Bridges, Sacramento, Calif.

UTILIZATION OF SEWAGE SLUDGE AS FERTILIZER—Manual of Practice No. 2. Federation of Sewage Works Assoc., 325 Illinois Bldg., Champaign, Ill.

JOURNAL OF THE INDIAN ROADS CONGRESS—Vol. X-1-2-3-4. Dec. 1945, Jan. and Aug. 1946., New Delhi, India. 5s.

CURRENT ROAD PROBLEMS—SOILS—BITUMINOUS ROADS—No. 12. Highway Research Board, 2101 Constitution Ave., Washington 25, D. C.

SPECIFICATION FOR THE DESIGN OF LIGHT GAGE STEEL STRUCTURAL MEMBERS—American Iron and Steel Institute, 350 Fifth Ave., New York 1, N. Y.

APPLICATION OF SHAPED EXPLOSIVE CHARGES TO MINING OPERATIONS: TESTS ON STEEL AND ROCK—By R. S. Lewis and G. B. Clark. Bulletin No. 1. Dept. of Mining Engineering, University of Utah. Salt Lake City, Utah. $1.25.

PRESSURE OF PLASTIC CONCRETE ON FORMS—Reprint from the *Proceedings* of the Society for Experimental Stress Analysis. Available from the author, Charles Macklin, R. R. No. 6, Springfield, Ill.

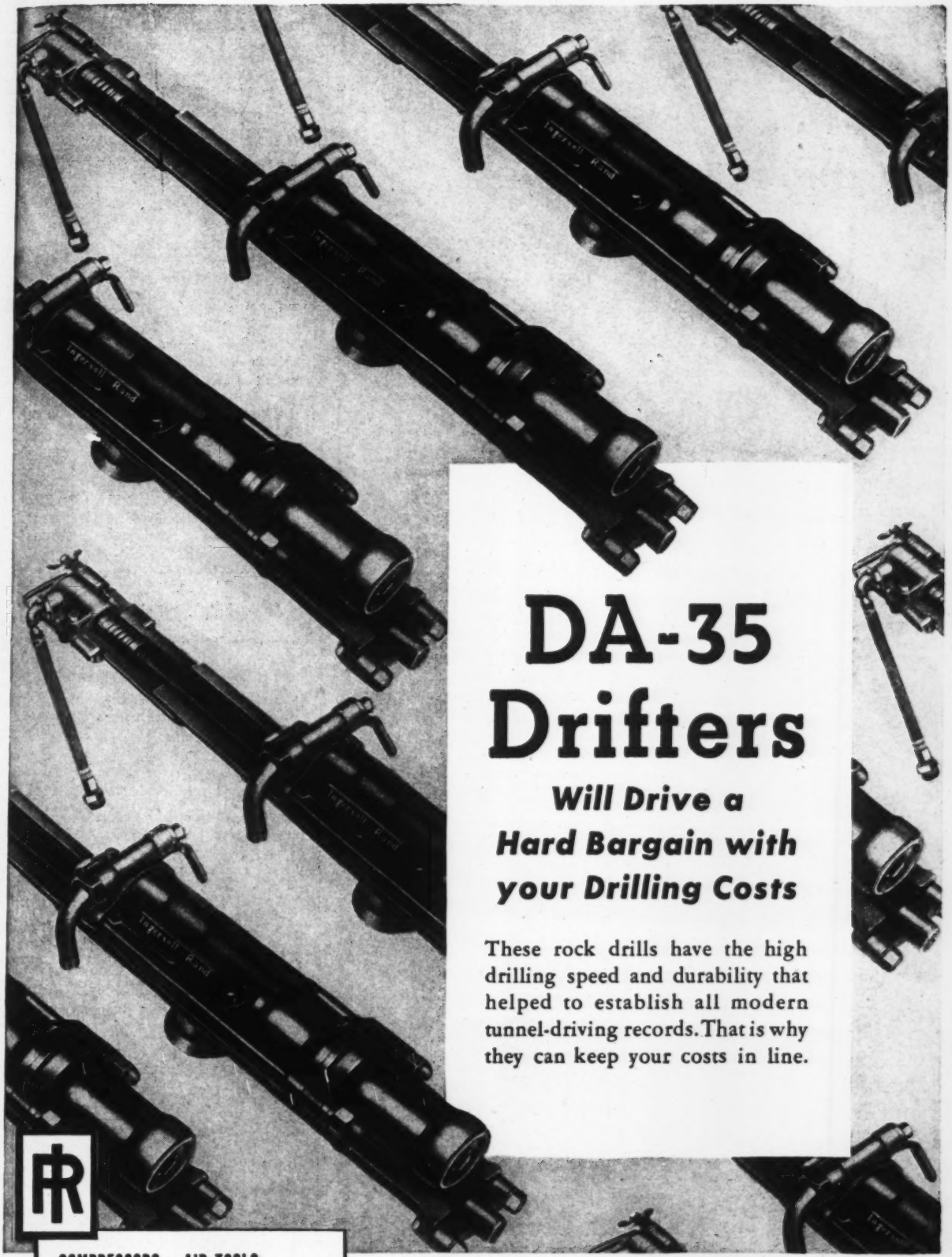
A.S.T.M. STANDARDS ON CEMENT (With Related Information)—American Society for Testing Materials, Philadelphia 3, Pa. $2.00.

A STUDY OF CLASSIFICATIONS AND SALARIES FOR ENGINEERING JOBS IN LOS ANGELES COUNTY SERVICE—Report to the Board of Supervisors, Los Angeles County by A. P. Richmond, Jr., American Society of Civil Engineers, 33 W 39th St., New York 18.

APPROVED STATE AND MUNICIPAL PROJECTS—New York State Postwar Public Works Planning Commission, Albany, N. Y.

GROUND WATER AT DICKINSON, NORTH DAKOTA—By T. G. McLaughlin. North Dakota Ground-Water Studies No. 3.

GROUND WATER RESOURCES OF THE GLACIAL



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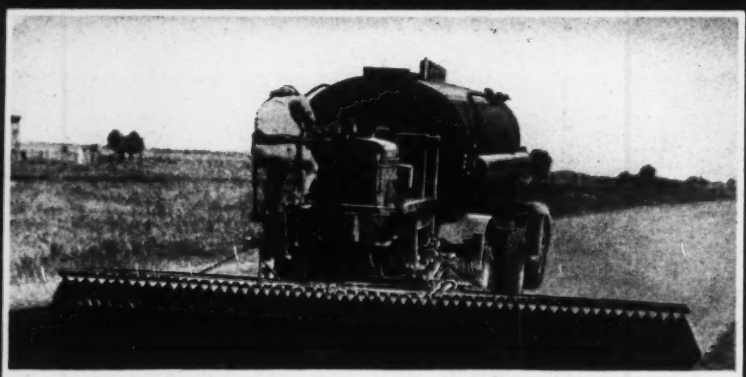

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DEPOSITS IN THE VICINITY OF CANTON, OHIO—Bulletin No. 3, Ohio Water Resources Board, Columbus, Ohio.

REPORT ON THE MICHIGAN PUBLIC IMPROVEMENT PROGRAM—Michigan State Administrative Board, Building and Construction Division, Lansing, Mich.

AIRPORT PLAN FOR FORT WORTH METROPOLITAN AREA—A report to the City Council. Carter & Burgess. Consulting Engineers, Fort Worth, Texas.

TRAFFIC SURVEY NEW ORLEANS METROPOLITAN AREA—1944-45—Louisiana Department of Highways, Baton Rouge, Louisiana.

PROPOSED LOWER MANHATTAN CROSSTOWN EXPRESSWAY—Obtainable from the Office of the Borough President of Manhattan, Municipal Building, New York.

REPORT ON EXPRESS HIGHWAYS—Richmond-Petersburg District—Prepared for the Department of Highways, Richmond, Va.

ARTERIAL PLAN FOR NEW ORLEANS—A report to the Louisiana Department of Highways by Robert Moses, and Andrew G. Clark, Consulting Engineers, New York.

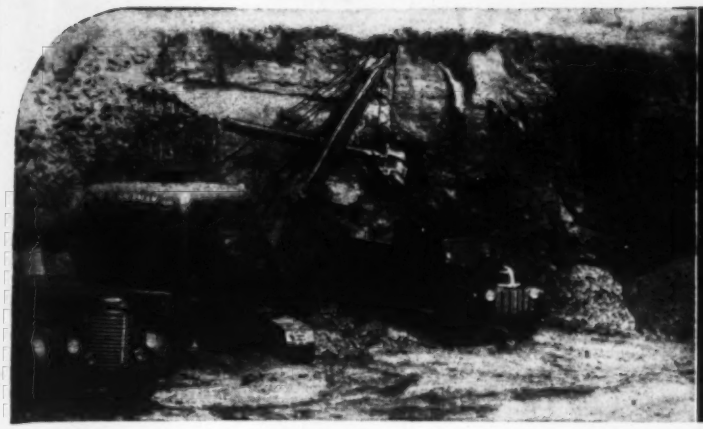
SELECTED MEASURES FOR THE PARTIAL RELIEF OF TRAFFIC CONGESTION IN NEW YORK CITY—A report to the City Planning Commission by Garo Dunn, W. Earle Andrews, and Gilmore D. Clark.

Men and Jobs

Maj. Newton E. Wise recently gave up a commission with the U. S. Engineers' District Sacramento, Calif., to become civilian administrative office of the district. Wise, who served as 2nd lieutenant with the 319th Engineers in Brest, France, in World War I, signed on as civilian with the Sacramento district, later was recommissioned to expedite military construction in the area from the coast range to Colorado.

William C. Custer has opened an office for the practice of structural engineering at 77 Summer Street, Boston 10, Mass. He is a graduate of Tufts College, 1926, and was formerly with the N. E. Power Service Co. and Charles T. Maine, Inc.

John D. Barfield, Jr., construction engineer with the Louisville, Ky., District U. S. Engineers, has been given a furlough to be plant manager for the Stiers Realty Service Co., St. Louis, Mo., at the Kentucky Ordnance Works, Paducah, a surplus TNT manufacturing plant. During the war Mr. Barfield



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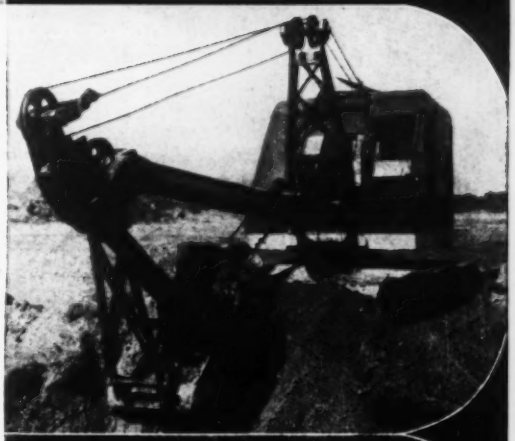

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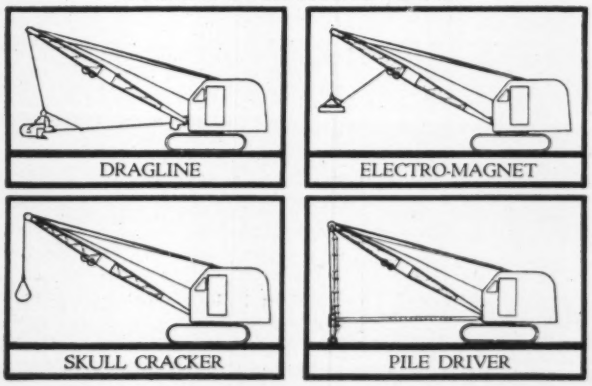

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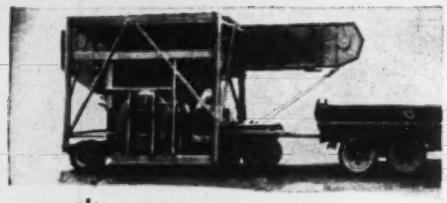

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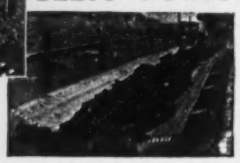

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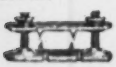

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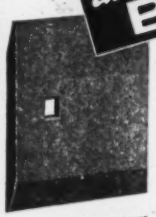

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served the Corps of Engineers on various military construction projects including Camp Breckinridge, Studebaker Proving Grounds and Kokomo Airport.

Lester Abramson is now a structural engineer for the Bureau of Reclamation at Denver, Colo., having been transferred from the U. S. Navy Department where he was a structural designer for about seven years. He had two years of building construction work in N. Y. City and Westchester County. He received his bachelor or civil engineering degree at the school of technology, College of the City of New York in 1941.

Col. J. S. Seybold, USA, has been named district engineer for the Corps of Engineers in the Baltimore, Md., area, succeeding **Col. W. M. Allison,** who has been transferred to the Engineer Command at Elgin Field, near Valparaiso, Fla. Colonel Seybold, who has spent 26 years in the Corps of Engineers went from Syracuse, N. Y., where he had been district engineer. He left when the districts in that region were consolidated. Two other ranking officers went to Baltimore with him, **Lieut. Col. J. P. Campbell,** district executive officer and **Lieut. Col. B. C. Samples,** chief of the construction division.

Irving C. Harris has been appointed construction engineer at Shasta Dam, Calif. Formerly acting constructing engineer at the dam, he is in charge of all work at Shasta and Keswick dams and on the Oroville-Sacramento transmission line. Under his direction the dams will be completed and the remaining turbines, generators, and other facilities will be installed. In 1900 Mr. Harris was graduated from the California Institute of Technology. In 1909 he became power engineer on Arizona's Salt River Project, leaving in 1916 to become a consulting engineer. In 1933 he was appointed to the power division at Boulder Dam where he later became director of power. He transferred to Shasta Dam as senior engineer in 1941.

Robert F. Eastman has been elected Clark County, Ohio, engineer.

Beverley K. Boulton has resigned as president of Wartime Housing, Ltd., set up to provide low cost and low rental housing at large munitions plants in Canada during the war. More recently, the organization has been erecting low cost housing for veterans. During Mr. Boulton's tenure 6,300 low cost housing units have been completed and 5,500 additional ones placed under construction. All other housing activi-

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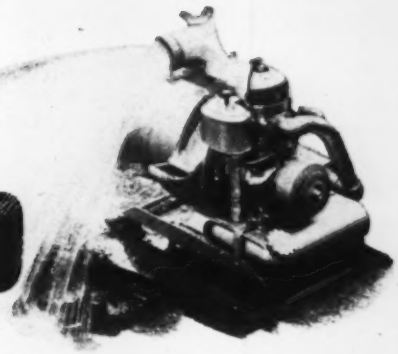

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SAVING WAYS IN DOORWAYS

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ties of the government are now handled by the Central Mortgage and Housing Corp., another government-owned undertaking.

Col. Alexander M. Nielson who recently went to Cincinnati, Ohio, to head the district engineer's office, as of Dec. 1, heads the Huntington, W. Va., office, succeeding **Col. Frank W. Gano,** transferred to Ft. Benjamin Harrison, Ind. Colonel Nielson was graduated from the U. S. Military Academy in 1918 and later from the Engineer School at Ft. Belvoir, Va.

Harry P. Burleigh will head the recently established Pecos River Basin Co-ordination office, with headquarters in Carlsbad, N. M., it was announced recently by Wesley R. Nelson, Regional Director of the Bureau of Reclamation. This office was established to co-ordinate the work of bureau planning engineers in New Mexico and Texas. The foremost problem confronting Burleigh will be studies for the rehabilitation of the irrigation works of the Carlsbad, N. M., Project.

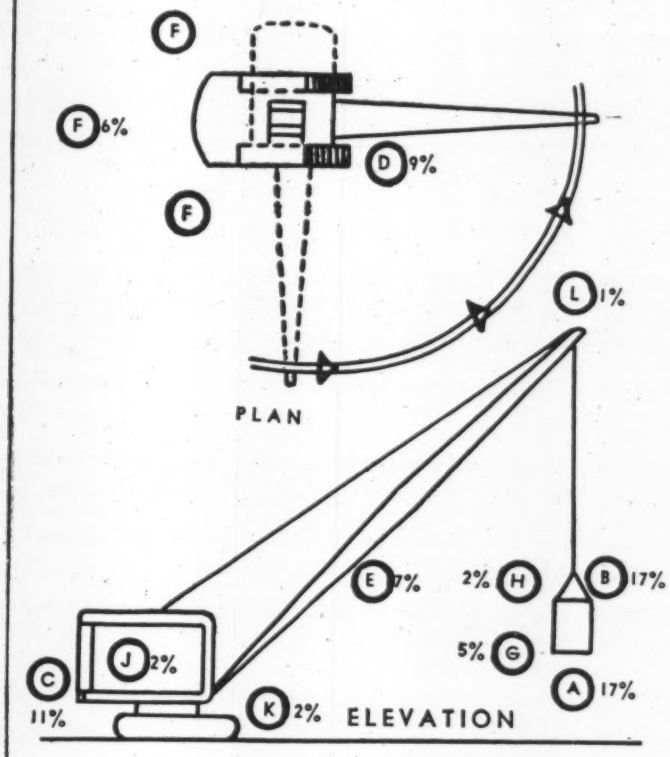
Formerly Burleigh was a geologist with the Soil Conservation Service in Washington, D. C., and served in the Bureau of Agricultural Economics, Department of Agriculture, from 1935 through 1943. He is a graduate of the University of Nebraska, and a veteran, having served three years with the Corps of Engineers. He was discharged last January, with the rank of major.

The firm of J. J. Allinson & Son, Inc., has been organized at Houston, Tex., for engineering and construction of petroleum and heavy chemical plants. The firm will be headed by **J. J. Allinson,** formerly chief resident engineer with The Kellex Corp. at the atomic bomb project, Oak Ridge, Tenn. **C. G. Kirkbride,** vice-president, will act as consultant on design and engineering.

A. J. Mahoney, structural engineer of Seattle, Wash., has joined the General Engineering Co. of that city. Formerly he was with Engineering Associates, the Seattle city engineering department and the Austin Co.

J. A. Mather of Fort Pierce, Fla., has been appointed maintenance engineer of the state road department for the counties of Indian River, St. Lucie and Okeechobee, succeeding **Tollie Bass,** also of that city. Mather has been with the department since 1930 as project engineer and inspector.

J. Y. Patton, resident engineer for District 8, North Wilkesboro, N. C., for the N. C. State Highway & Public Works Commission, has resigned to be-



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E — 7% Failure of defective boom, cable or sheaves
F — 6% Working or standing in line of crane body or boom
G — 5% Pushing load by hand, including electric shock
H — 2% Hooking, coupling, hitching, etc. with hands in pinch point
J — 2% Failure due to overloading
K — 2% Ascending and descending cab without using ladder
L — 1% Operating too near stationary equipment

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come associated with William F. Freeman, consulting engineer of High Point, N. C. E. Ford King, Jr., resident engineer at Elkin for N. C. State Highway and Public Works Commission will succeed Mr. Patton.

John O. Williams, for 14 years with the Cuyahoga County engineering office at Cleveland, Ohio, has resigned, effective Dec. 31, to devote his entire time to Plastic Engineering, Inc., of which he is president.

George V. Weatherston, Ashtabula, Ohio, has been elected Ashtabula County engineer. An employee of the county highway department since 1922, he will serve the unexpired term of the late Charles O. Topper.

R. E. Coblentz, structural engineer, has joined the staff of A. M. Strauss, Fort Wayne, Ind. A graduate of Purdue University with a degree in civil engineering, Mr. Coblentz was with the American Bridge Co., Ambridge, Pa., from 1930 to 1935, and with Hugh J. Baker Co., Indianapolis, from 1935 to 1941, when he entered military service. Discharged with the rank of major in 1945, he returned to the Baker Co.

Elmer E. Gunnette of Tacoma, Wash., has been appointed district engineer for Washington, Oregon and Idaho, for the American Institute of Steel Construction. Mr. Gunnette served as chief engineer and later as general manager of the Miller Construction Co., Tacoma. He is a graduate of the Westlake School of Marine Engineering and has pursued further studies in the engineering and architectural school of the University of Washington.

C. M. Corbit, Jr., graduate engineer, University of Pittsburgh, has been appointed by the institute to fill the newly-created post of district engineer for Southern California. A resident of South Pasadena, he served for a number of years as a representative of Bethlehem Steel Corp. in that area.

W. G. Shull, resident engineer at Raleigh, N. C., for the North Carolina Highway Commission, has been transferred to Wilson, N. C., where he is making a survey of the bridges in the area to determine their load capacity. He is being assisted by W. G. Barnes, rodman. J. W. Ferguson has taken over as resident engineer at Raleigh.

George B. Cherry, of Raleigh, N. C., an engineer with the North Carolina Department of Labor for the last three years, has been named superintendent

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Naturally, this means a tight supply situation for housing which does not come under the program, and for all other construction and industrial uses.

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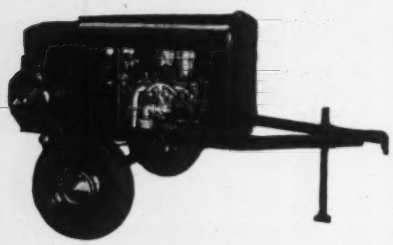

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of state buildings and grounds at Raleigh. He was graduated from North Carolina State College in 1922, and prior to joining the labor department was an engineer with the North Carolina Highway Commission and the Sanborn Map Co. of Pelham, N. Y. He is vice-president of the Raleigh Engineers Club.

Edward L. Blackwell, engineer at Florence, S. C., Army airfield, and with the Army engineers when that base was constructed, has been made city manager of Florence.

Two engineers on Tacoma's Second Nisqually Power Development near Tacoma, Wash., have taken new positions. **J. Verne Gongwer,** chief engineer in charge of construction, resigned that City Light position to engage in consulting engineering in Tacoma. **George A. Gregory,** who has had charge of the construction of the Alder Dam and powerhouse, is leaving for China to be principal construction engineer for the national hydroelectric bureau of the National Resources Commission of China.

Gongwer had been with Tacoma City Light intermittently for 18 years, serving first as structural engineer in charge of the designing and drafting room on the Cushman No. 1 project and supervising the design and construction of the record long double circuit span across the Narrows. He also supervised design and construction of Cushman No. 2 powerhouse and supervised plan design for the City Light steam plant. For a time he was with TVA on the Guntersville Dam, lock and powerhouse. He studied engineering at Michigan State College, then became a railroad surveyor and later worked for the Michigan highway department, the cities of Seattle, Wash., Corvallis and Portland, Ore., and the Port of Tacoma.

K. M. McGhie of Rochester, Minn., has resigned from the Minnesota highway department to set up his own civil engineering and surveying office.

J. L. Mayes, Materials testing engineer with H. C. Nutting, Cincinnati, Ohio, is taking a similar position for the Illinois Department of Aeronautics, Springfield. Recently he was chief testing engineer for the Springfield Municipal Airport.

A. B. Lanfair has gone with the Illinois Department of Aeronautics, Springfield, as construction engineer. During the war he served as captain in the Southwest Pacific with the U. S.

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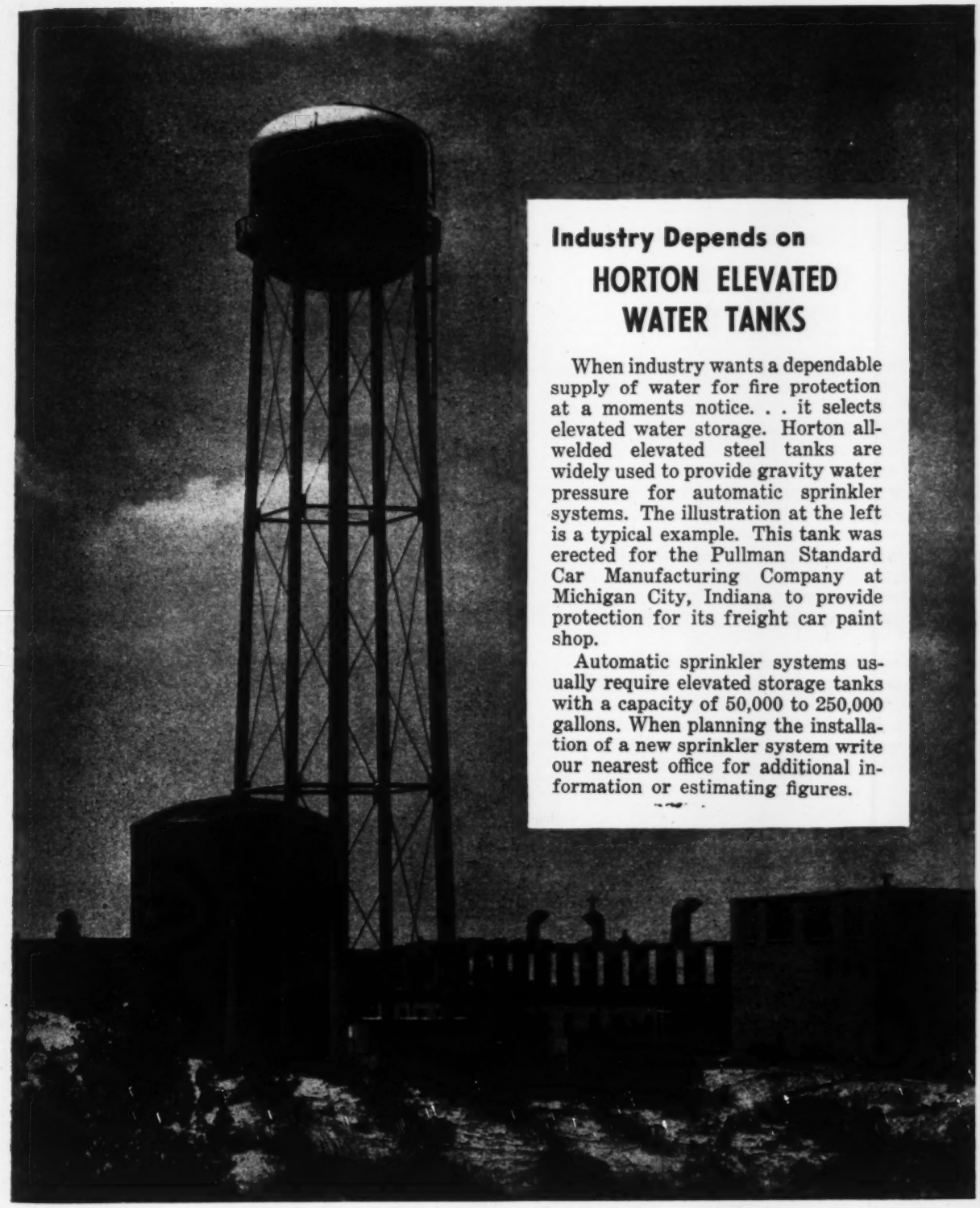

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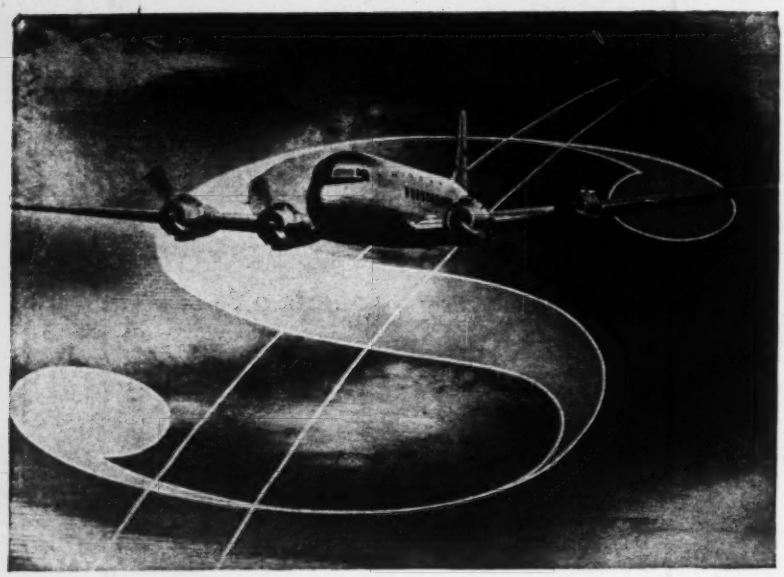

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Engineers and before that he was with the Illinois Division of Highways and with Sverdrup and Parcel, St. Louis, Mo., consulting engineers.

John E. Kellogg has left his position as assistant highway engineer, railroad crossings, Illinois Division of Highways, to become design engineer, Illinois Department of Aeronautics, Springfield. From September, 1937, to April, 1941, when he joined the U. S. Engineers, and again from March, 1946, until his recent move, Mr. Kellogg was with the Illinois Division of Highways. During the war he served as captain in the U. S. Engineers, for 14 months overseas in New Guinea and the Southwest Pacific area.

A. E. Bourbeau, a graduate of L'Ecole Polytechnique, Montreal, and of the Massachusetts Institute of Technology, and former city engineer of St. Hyacinthe, Que., has been appointed director of two training centers operated by the Montreal Building Trades Apprenticeship Commission.

William R. Milward, III, has resigned as personnel supervisor of the Kentucky State Highway Department to go into private business. He is succeeded by **Victor E. Comley,** who returned to the highway department a year ago on discharge from military service.

F. W. Thorstenson, formerly with the Minneapolis, Minn., office of the Portland Cement Association, is now working in the Fish and Wild Life Service Office in Minneapolis.

Max W. Garnett, city engineer of East Cleveland, Ohio, for the last 25 years will resign Dec. 31. Mr. Garnett designed the city's major sewer lines and supervised conversion of the John D. Rockefeller estate into Forest Hill Park residential area. In October he completed four years as a major in the Army Corps of Engineers. Mr. Garnett will be succeeded by N. W. Nestor, assistant city engineer now and formerly assistant engineer for Dayton, Ohio.

John Bliss, engineer for the Interstate Streams Commission, has been appointed New Mexico State Engineer to succeed Thomas M. McClure who died recently. Bliss has been with the engineer's office for 20 years and had served as assistant state engineer before taking the position as engineer to the interstate streams commission.

Pennsylvania's Highway Department has announced the resignation of **Louis A. Benham,** Philadelphia, resident engineer, and **Harold S. Butz,** Lancaster, project engineer.